Bay Point System Water Master Plan

Golden State Water Company

December 2019

Executive Summary

Purpose

The purpose of this Master Plan is to assess Golden State Water Company's (GSWC) Bay Point System's ability to meet current and future water needs, and to identify upgrades needed if deficiencies exist. This assessment is developed by using hydraulic analysis criteria, future demands and available supply, water quality standards, and condition of facilities.

These updates provide GSWC with a basis to determine the impacts of new development on the existing system and to identify system deficiencies and improvements needed to correct them. These system improvement needs are used as the basis for developing the Capital Improvement Program (CIP) for the system. TABLE 9-1 summarizes the CIP projects identified in this master plan.

GSWC's goal is to meet the minimum requirements identified in the technical memorandum titled *Golden State Water Company Master Planning Criteria and Standards* (see Appendices).

Master Plan Process

This master plan document is organized as follows:

- Update existing system information
- Establish existing demands and forecast future demands
- Update system's hydraulic model
- Evaluate supply and storage capacities
- Perform hydraulic analyses and evaluation
- Identify water quality issues
- Assess condition of facilities in the system
- Develop CIP

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Acronyms and Abbreviations

1,1-DCE	1,1-dichloroethylene
2015 UWMP	2015 Urban Water Management Plan
2016 WMP	Bay Point 2016 Water Master Plan
AACE International	Association for the Advancement of Cost Engineering International
ADD	average day demand
AFY	acre-feet per year
amsl	above mean sea level
AOB	ammonia-oxidizing bacteria
CCWD	Contra Costa Water District
CIP	capital improvement program
CPUC	California Public Utilities Commission
DDW	State Water Resources Control Board, Division of Drinking Water
DPB Rule	Disinfectants and Disinfection Byproducts Rule
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
FCV	flow-control valve
fps	foot or feet per second
GAC	granular activated carbon
gpm	gallons per minute
GSWC	Golden State Water Company
GWO	General Work Order
HPC	heterotrophic plate count
IDSE	Initial Distribution System Evaluation
MCL	maximum contaminant level
MDD	maximum day demand
MG	million gallons
MHD	minimum hour demand

NAICS	North American Industry Classification System
NOB	nitrite-oxidizing bacteria
O&M	operations and maintenance
PCE	tetrachloroethylene
PHD	peak hour demand
PRV	pressure-regulating valve
psi	pounds per square inch
PSV	pressure-sustaining valve
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
TDS	total dissolved solids
TTHM	total trihalomethanes
UWMP	Urban Water Management Plan
VOC	volatile organic compound
WMP	Water Master Plan

SECTION 1

Introduction

1.1 Overview of Golden State Water Company

GSWC is a subsidiary of American States Water Company, an investor-owned utility dedicated to increasing value through the expert management of utility assets and services. As a public utility, GSWC is committed to the purchase, production, distribution, and sale of water to over 260,000 customer connections.

GSWC is organized into three regions throughout the state of California. Region I is located in northern and central coast of California. Region II serves communities in Los Angeles County. Region III serves communities in Los Angeles, San Bernardino, Imperial, and Orange counties.

FIGURE 1-1, provided at the end of this section, shows the locations of all GSWC water systems.

1.2 Master Plan Update

The purpose of this master plan is to assess the Bay Point System's ability to meet current and future water needs and recommend system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, system demands and available supply, and facility condition assessments.

Specifically, this master plan supports GSWC's effort to update existing master plans and hydraulic models for water systems throughout the company. These updates provide GSWC with a baseline for determining the impacts of new development on existing systems as well as identifying short, mid, and long term system needs. These system needs are used as the basis for developing the capital improvement program (CIP) for the system. The primary drivers of this master plan update are the following:

- Assess the distribution system's hydraulic performance
- Identify infrastructure that is in poor condition and needs to be replaced
- Identify supply and storage needs
- Identify water quality and treatment needs
- Provide documentation for the proposed CIP projects in support of the General Rate Case for the California Public Utilities Commission (CPUC)
- Reduce operations and maintenance (O&M) efforts and costs required to maintain service under current conditions
- Minimize service failures

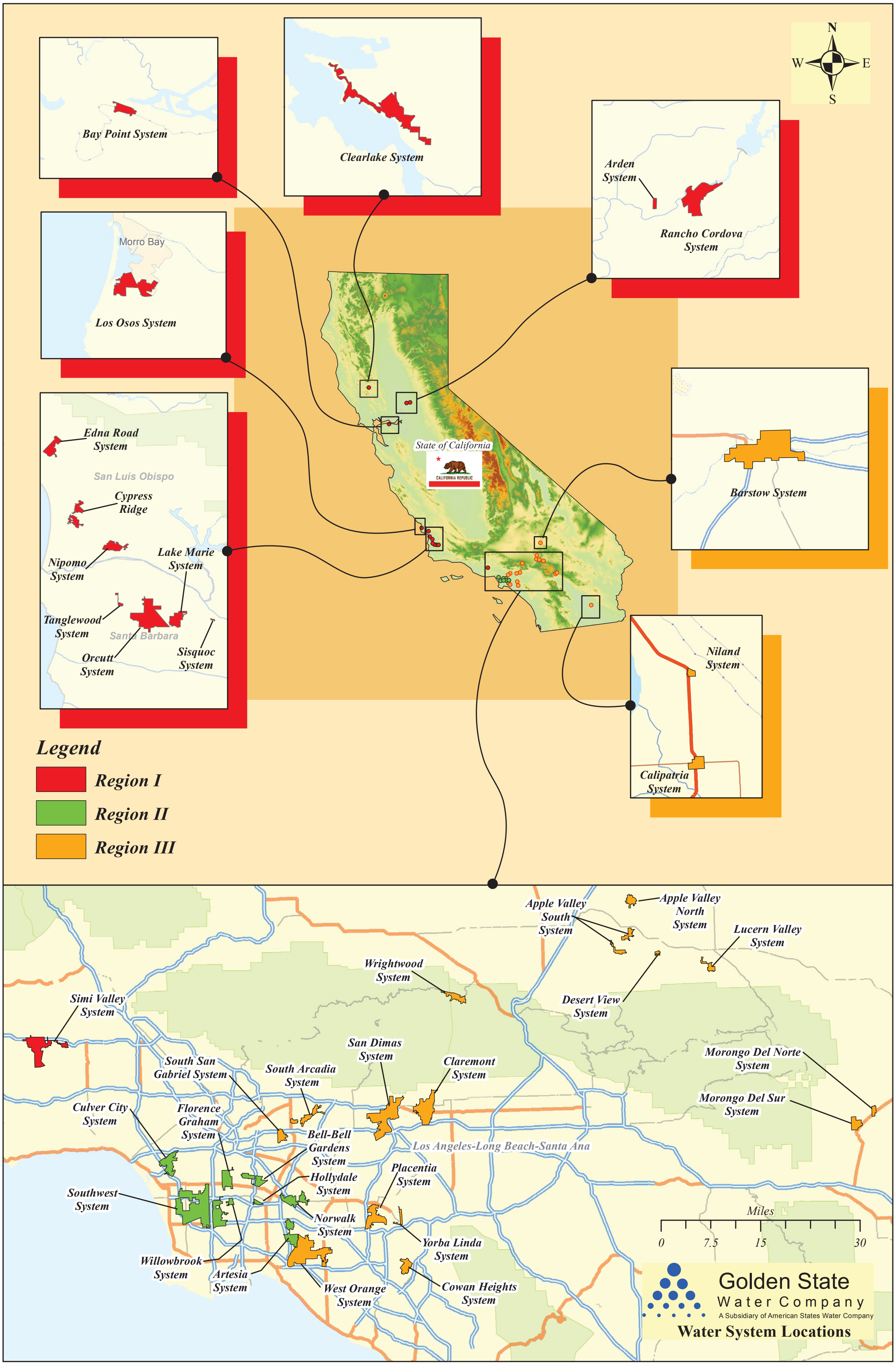
1.3 Document Organization

This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical evaluation of the system from existing facilities and requirements through future needs. Each section's title and a brief summary are as follows:

1. **Introduction:** Provides background information on the company and its systems.
2. **Existing Water System Facilities:** Provides an overview of the system and its facilities. System facilities identified include the system service area boundary, pressure zones, distribution areas, supply sources, storage facilities, pump stations, pressure regulating and water control stations, and transmission and distribution pipelines.
3. **Existing and Future Demands:** Provides definition of demand types and periods, as well as existing and future demands. Explains the demand development approach and determination of peaking factors. Provides the current demands and projected demands developed for a future 2040 condition. Future demands are based on population growth rate and water use projections.
4. **Hydraulic Model Development and Calibration:** Provides an overview of the modeling process, including hydraulic model construction and calibration.
5. **Supply and Storage Capacity Evaluation:** Documents the evaluation of the system's water supply and storage capacity using the objectives identified in GSWC's *Master Planning Criteria and Standards.* The evaluation results establish supply and storage needs for each distribution area and the entire distribution system. Existing and future supply and storage deficiencies are also identified. Recommended improvements to mitigate deficiencies are also provided.
6. **Hydraulic Analysis and Evaluation:** Outlines the approach for the hydraulic analysis. Details how the updated hydraulic model was used to determine hydraulic deficiencies under simulated demand scenarios and was compared with the analysis and planning criteria for short, mid, and long term planning periods. Provides recommendations to address deficiencies that were identified. Scenarios simulated by the hydraulic model include average day, maximum day, and peak hour conditions.
7. **Water Quality Analysis:** Provides GSWC's evaluation of water quality based on current and pending federal and state standards and rules.
8. **System Condition Assessment:** Provides GSWC's documentation of system condition assessment efforts including past efforts, recent field inspections, and recommendations for future improvements.
9. **Capital Improvement Program:** Describes the CIP plan resulting from all preceding tasks broken down into short, mid, and long term planning periods. This includes prioritization and justification for the projects included in the CIP.
10. **References:** Lists the primary sources of information referred to throughout the master plan.

Appendices provide supporting information on various specifications and details referred to throughout the master plan.

Figures



GSWC Engineering Planning October 2017

SECTION 2

Existing Water System Facilities

This section documents existing water system facilities for the Bay Point System. Detailed information about the major facilities, such as water supply facilities, storage facilities, pipelines, pumping facilities, and regulating valves serves as the basis for subsequent system analysis throughout the master plan. This section begins with an overview of the system, and then presents detailed information about these facilities.

2.1 Overview

The Bay Point System is located in Contra Costa County, covers approximately 3.3 square miles, and serves the community of Bay Point and parts of the City of Pittsburg.

The Bay Point System obtains its water supply from groundwater and two treated water interconnections with Contra Costa Water District.

The Bay Point system has approximately 50 miles of pipelines that range in diameter from 2 to 16 inches.

2.2 Facility Descriptions

The major system facilities are shown in FIGURE 2-1 at the end of this Section. These facilities are discussed in detail in the following subsections:

- Pressure zones
- Supply sources
- Storage facilities
- Pumping stations
- Pressure regulating stations and flow control stations
- Transmission and distribution pipelines

2.2.1 Pressure and Distribution Zones

The Bay Point System is comprised of six pressure zones. The Bay Point System's Customer Service Area (CSA) ranges in elevation from approximately 10 to 410 feet above mean sea level (msl). TABLE 2-1 provides details of these pressure zones and lists the PRVs and/or booster stations that connect the zones. FIGURE 2-2 presents the system's hydraulic profile (schematic of the water system).

TABLE 2-1 Pressure Zone Details

Pressure Zone	HGL (ft msl)	Elevations Served (ft msl)	Supply and Storage Facilities*		
			Storage Tanks	Wells and Purchased	PRV/Booster Stations
Skyline Reservoir	520	255-410	Skyline Reservoir	-	Evora Booster Station
Evora Reservoir	415	110-290	Evora Reservoirs 1 and 2	-	PRV from Skyline Reservoir Zone Pacifica Booster Station
Marcia Booster Zone	300	120-130	-	-	Marcia Booster Station
Madison Reservoir	265	75-170	Madison Reservoir	-	Chadwick Booster Station
Riverside	237	70-110	-	-	PRV from Evora Reservoir Zone
Hill St. Reservoir	209	10-115	Hill Street Reservoir 3	Hill Street Wells #1 and #2, Chadwick Well #3 Port Chicago CCWD Interconnection, Hill Street CCWD Interconnection	PRVs from Madison Reservoir, Marcia Booster and Riverside Zones

* Does not include hydropneumatic tanks or emergency interconnections.

2.2.2 Supply Sources

GSWC currently obtains its water supply for the Bay Point System from two primary sources: imported water and GSWC owned and operated groundwater wells. The Bay Point System also has one emergency interconnection.

Groundwater

The system has three active wells; their locations are identified in FIGURE 2-1. The groundwater from these wells meets state and federal water quality standards. The water from one well, Chadwick #3, is pumped directly into the distribution system. The other two wells, Hill Street #1 and #2, are blended with treated CCWD water from the Hill Street CCWD Interconnection, and then conveyed into Hill Street Reservoir 3.

Active Wells

Three groundwater wells were identified as active for this master plan. TABLE 2-2 presents the relevant data for these wells. The elevation shown for each well is the elevation of the wellhead facilities. The pumping water level is the depth measured from the wellhead to the surface of the groundwater while the well pump is running. Pumping water levels were based on recent levels monitored and recorded by GSWC. The groundwater elevation was calculated by subtracting the pumping water level from the wellhead elevation. Well capacities are based on facility design capacities, which may vary slightly with recent pump test data. Total dynamic head (TDH) represents the amount of energy required by the pump to produce water at the given flow rate. The discharge location describes where the well pump discharges.

TABLE 2-2 Active Wells

Well	Discharge Location	Wellhead Elevation (ft msl)	Pumping Water Level (ft)	Pumping Groundwater Elevation (ft msl)	TDH[a] (ft)	Capacity[b] (gpm)
Hill Street #1	Hill Street Res 3	105	99	6	280	125
Hill Street #2	Hill Street Res 3	165	394	-229	415	88
Chadwick #3	Hill Street Reservoir Gradient	110	147	-37	235	45
Total groundwater production capacity						**258**

msl: above mean sea level

[a] TDH is based on pump design point data.
[b] Capacity is based on facility design capacity, under normal operating conditions, and may not reflect actual capacity at a given point in time.

Non-operational Wells

The system has no non-operational wells. A summary is provided in TABLE 2-3.

TABLE 2-3 Non-Operational Wells

Well	Discharge Location	Elevation (ft msl)	Previous Capacity (gpm)	Reason
-	-	-	-	-

Purchased Water

All purchased water used in the Bay Point System is provided by the Contra Costa Water District (CCWD) at two service connections. These imported water supply connections are presented in TABLE 2-4.

Prior to January 2009, TTHM issues existed in the Bay Point distribution system as a byproduct of the treatment process of raw water at the Hill Street Surface Water Treatment Plant (HSTP). An interconnection with Contra Costa Water District (CCWD), the Hill Street CCWD Interconnection, was constructed and now provides potable water treated at CCWD's Randall-Bold Water Treatment Plant (RBWTP), which utilizes chloramines as the residual disinfectant. The Interconnection was identified as the preferred alternative to the installation of an ammonia feed system (and fluoridation) on the treatment train at the HSTP – the CCWD treated water supply is already chloraminated and fluoridated. The capacity of the Interconnection replaces the production capacity of the HSTP, and allows GSWC to serve CCWD treated water to customers in lieu of water treated at the HSTP. The HSTP was taken offline when the new Interconnection was activated, and has since been decommissioned and razed.

TABLE 2-4 Imported Water Supply Connections

Imported Water Supply Connection	Hydraulic Grade Line (ft msl)	Capacity (gpm)	Pressure Setting at Connection* (psi)	Ground Surface Elevation (ft msl)	Imported Water Supply Pipeline
Port Chicago CCWD Interconnection	209	1,017[a]	69	50	Dedicated 16” pipeline from CCWD Bollman WTP
Hill Street CCWD Interconnection	209	4,070[b]	80	125	CCWD Multi-Purpose Pipeline (MPP)

* The fixed-head elevation at the service connection is calculated as the sum of the elevation of the centerline of the control valve and the pressure head from the pressure setting.

[a] The 1994 Agreement with CCWD for the Port Chicago Interconnection requires a minimum take by GSWC at a daily average of 40 gpm. As of FY19, GSWC’s capacity right is 1,017 gpm. As more customers are added into the Bay Point System, they must buy system capacity from CCWD, which increases the capacity rights at Port Chicago to a maximum of 1,980 gpm.

[b] CCWD’s stated supply capacity through the Interconnection is 3,055 gpm (4.4 MGD), with an allowed peaking factor of 1.33 (providing a “peak supply” of up to 4,070 gpm over 18 hours, instead of 24, as necessary).

Emergency Interconnections

Water distribution systems are often connected to neighboring water systems to allow the sharing of supplies during short-term emergencies or during planned shutdowns of a primary supply source. The Bay Point System has one interconnection which is “normally closed” and must be manually opened to provide flow. This emergency interconnection is presented in TABLE 2-5.

TABLE 2-5 Emergency Interconnections

Interconnection Name/Location	Capacity* (gpm)	Notes
W. Leland Rd., east of Broadway Ave.	1,000	8-inch interconnection with City of Pittsburg

*Capacity of an emergency interconnection is not considered a reliable supply; rather, it is considered an “interruptible” supply, as it is based on whether or not the neighboring water agency has available water.

2.2.3 Storage Facilities

Water distribution systems rely on stored water to help equalize fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major supply source. This section describes the existing storage facilities in the system.

Storage Tanks

The Bay Point System has five storage tanks. There are two reservoirs, Hill Street Reservoirs 1 and 2, that are currently not in use. A summary of the active reservoirs is provided in TABLE 2-6.

TABLE 2-6 Storage Tanks

Facility	Type and Zone	Bottom of Tank (ft msl)	High Water Elevation (ft msl)	Tank Height (ft)	Diameter (ft)	Volume (MG)
Skyline Reservoir	Ground level, gravity to Skyline Zone	495	523	28	78	1.00
Evora Res 1	Ground level pumped to Skyline Zone, gravity to Evora Zone	393.5	425.5	32	55	0.40
Evora Res 2	Ground level pumped to Skyline Zone, gravity to Evora Zone	393.5	425.5	32	63	0.50
Madison Reservoir	Buried concrete, gravity to Madison Zone	250	265	15	96 x 76	0.52
Hill St. Res 3	Ground level, gravity to Hill Street Zone	171	209	40	67	1.00
Total systemwide storage capacity						**3.42**

2.2.4 Pumping Stations

Pumping stations are required to convey water from ground-level tanks into the distribution system or from lower-pressure zones into higher-pressure zones (usually called booster pumping stations). Pumping stations may consist of one or more individual pumps. Multiple pumps at each station, or multiple pumping stations that serve the same pressure zone, help to increase water system reliability by ensuring that water can still be delivered into that zone if one pump is out of service. Critical pumping stations may be equipped with emergency power supplies in case of failure of the primary power source.

The Bay Point System includes nine active booster pumps. Another booster station, at the Mota Plant site, has been unused/standby status for many years, and the current facilities are outdated and in need of repair. In order to maintain the site as a redundant booster location from the Hill Street Reservoir Zone to the Evora Reservoir Zone in the case of Pacifica Booster Station failure, a project has been identified in this Master Plan (see project 1.2.0, Table 8-1) to raze the existing, outdated facilities but maintain temporary piping/connections for installation of a portable booster station on an as-needed basis.

TABLE 2-7 presents data relevant to the water system analysis.

TABLE 2-7 Booster Pumps

Facility	Pressure Zones		Backup Power Available	Elevation (ft msl)	TDH[a] (ft)	Capacity[b] (gpm)
	Suction	Discharge				

Chadwick A	Hill Street Reservoir Zone	Madison Reservoir Zone	-	107	80	125
Chadwick B	Hill Street Reservoir Zone	Madison Reservoir Zone	-	107	80	125
Evora A	Evora Reservoirs	Skyline Reservoir Zone	-	393	115	675
Evora B	Evora Reservoirs	Skyline Reservoir Zone	-	393	115	675
Marcia A	Hill Street Reservoir Zone	Marcia Booster Zone	-	137	85	40
Pacifica A	Hill Street Reservoir Zone	Evora Reservoir Zone	-	62	220	650
Pacifica B	Hill Street Reservoir Zone	Evora Reservoir Zone	-	62	221	650
Port Chicago A	Port Chicago CCWD Interconnection	Hill Street Reservoir Zone	-	50	57	700
Port Chicago B	Port Chicago CCWD Interconnection	Hill Street Reservoir Zone	-	50	57	700

msl: above mean sea level

[a] TDH is based on pump design point data.
[b] Capacity is based on facility design capacity.

2.2.5 Pressure Regulating and Flow Control Stations

Pressure regulating and flow control stations allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely depressurizing the higher zone. The water is transferred through a valve that reduces the pressure or controls the flow rate to a specified setting. Regulating valves can operate based on one or more controlling parameters. The operational controls important to this analysis include pressure reducing, pressure sustaining, pressure relief, and flow rate:

- **Pressure reducing valve:** modulates to maintain a preset minimum downstream pressure setting; if the downstream pressure drops, then the valve will open until the downstream pressure matches the pressure setting.
- **Pressure sustaining valve:** modulates to maintain a preset minimum upstream pressure setting; if the upstream pressure drops, then the valve will close until the upstream pressure matches the pressure setting.

- **Pressure relief valve:** opens when the upstream pressure exceeds a preset maximum pressure setting.
- **Flow control valve:** modulates to maintain a preset flow rate through the valve regardless of pressure.

There are six hydraulically-operated zone-separation valves in the Bay Point System, and one bypassed pressure reducing valve. (There are also multiple manual zone break valves (normally-closed) in the System.) TABLE 2-8 lists the relevant data for these valves.

TABLE 2-8 Pressure Regulating and Flow Control Valves

Name/Location	Pressure Zone: Upstream	Pressure Zone: Downstream	Type	Dia. (in)	Setting (psi)	Maximum Capacity[b] (gpm)
Chadwick Plant	Madison Reservoir Zone	Hill Street Reservoir Zone	PRV	8	29	3,100
Madison Ave., north of North St.	Madison Reservoir Zone	Hill Street Reservoir Zone	PRV	6	35	880
Canal Rd., west of Loftus Rd.	Madison Reservoir Zone	Hill Street Reservoir Zone	PRV	6	40	1,565
Marcia Plant	Marcia Booster Zone	Hill Street Reservoir Zone	Relief Valve	2	60	100
Mariners Cove Dr., north of Riverside Dr.	Riverside Zone	Hill Street Reservoir Zone	PRV	8	30	1,565
Mota Plant	Evora Reservoir Zone	Riverside Zone	PRV	8	45	1,565
Driftwood Dr., north of Coastview Ct.	Skyline Reservoir Zone	Evora Reservoir Zone	PRV	8	55	1,565
N. Broadway Ave, north of Willow Pass Rd.[a]	Hill Street Reservoir Zone	Hill Street Reservoir Zone	PRV	4	Bypassed	800

[a] This pressure reducing valve is bypassed; areas upstream and downstream of this PRV are in the Hill Street Reservoir Zone.
[b] Maximum capacity determined by lesser of 1) PRV capacity or 2) upstream/downstream pipeline size (flow at 10 ft/s).

2.2.6 Transmission and Distribution Pipelines

The Bay Point System has a total of 50 miles of pipe ranging in diameter from 2 to 16 inches. TABLE 2-9 lists the estimated footage of pipelines by diameter and material.

TABLE 2-9 Pipes by Size and Material

Diameter (in)	Length of Pipe by Material (ft): AC	CI	DI	PVC	STL	Total Length (ft)
2	39	-	-	-	435	**474**
4	20,099	-	344	502	369	**21,314**
4.5	-	-	-	-	779	**779**

6	63,087	1,438	1,208	1,444	-	**67,177**
8	67,202	1,008	15,141	30,734	1,164	**115,248**
10	6,746	3,861	60	3,792	172	**14,631**
12	-	-	13,840	21,482	-	**35,322**
16	-	-	4,886	1,403	-	**6,289**
Totals (ft)	157,174	6,307	35,478	59,356	2,919	**261,234**
Totals (mi)	29.8	1.2	6.7	11.2	0.6	**49.5**
Percent (%)	60.2	2.4	13.6	22.7	1.1	**100**

AC: asbestos cement or transite DI: ductile iron PVC: polyvinyl chloride
CI: cast iron STL: steel

TABLE 2-10 lists the estimated footage of pipelines by diameter and year constructed.

TABLE 2-10 Pipes by Size and Year Built

Diameter (in)	Length of Pipe by Year Built (ft)				Total Length (ft)
	Pre 1960s	1960-1979	1980-1999	2000-2019	
2	213	140	121	-	**474**
4	-	18,508	2,599	207	**21,314**
4.5	-	779	-	-	**779**
6	80	39,521	26,837	740	**67,177**
8	-	39,653	60,210	15,385	**115,248**
10	3,861	1,961	8,741	69	**14,631**
12	-	139	26,082	9,101	**35,322**
16	-	-	5,992	297	**6,289**
Totals (ft)	4,154	100,701	130,582	25,799	**261,234**
Totals (mi)	0.8	19.1	24.7	4.9	**49.5**
Percent (%)	1.6	38.5	50	9.9	**100**

Figures

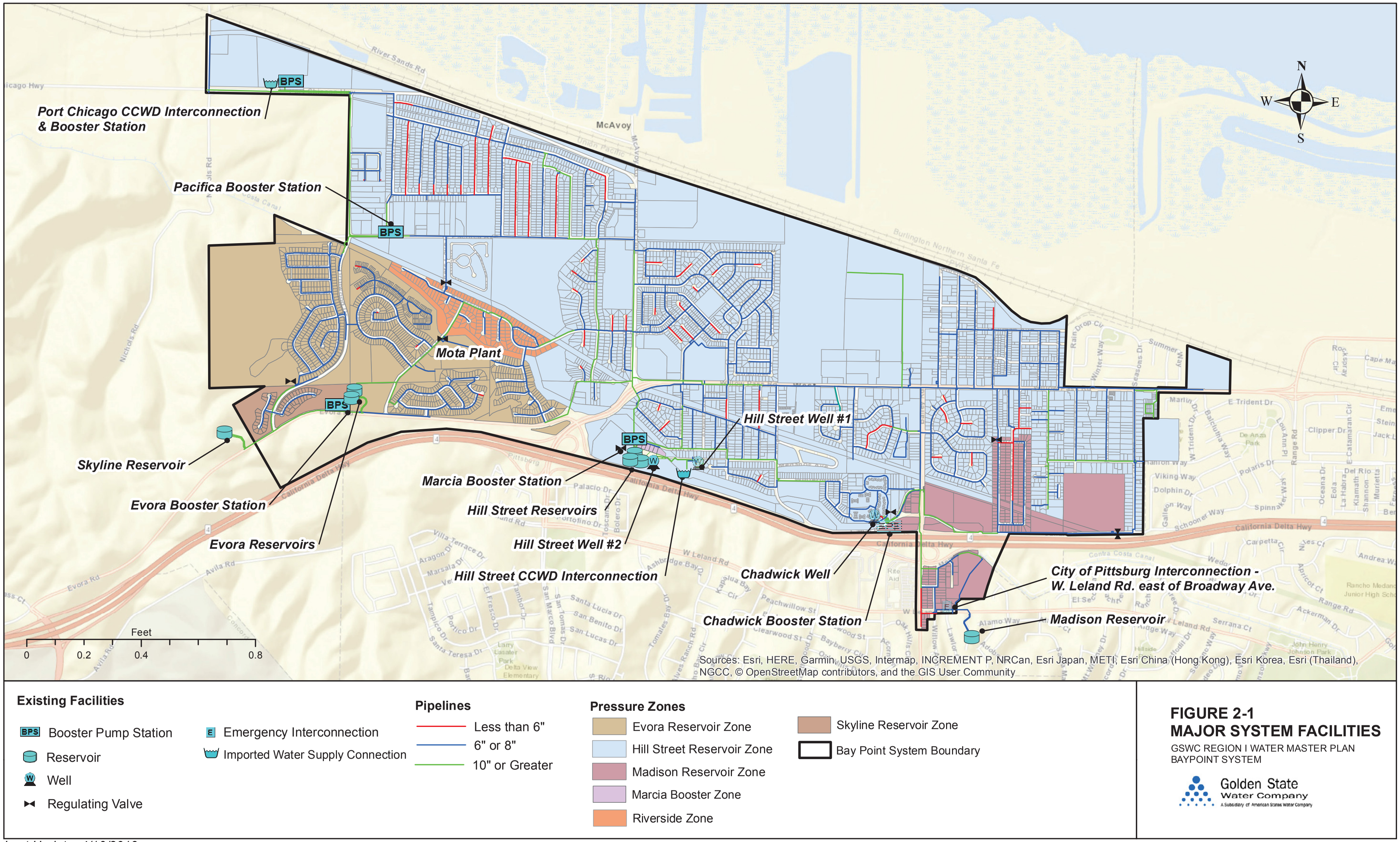


FIGURE 2-1
MAJOR SYSTEM FACILITIES
GSWC REGION I WATER MASTER PLAN
BAYPOINT SYSTEM

Last Update: 4/10/2019

Bay Point System Schematic

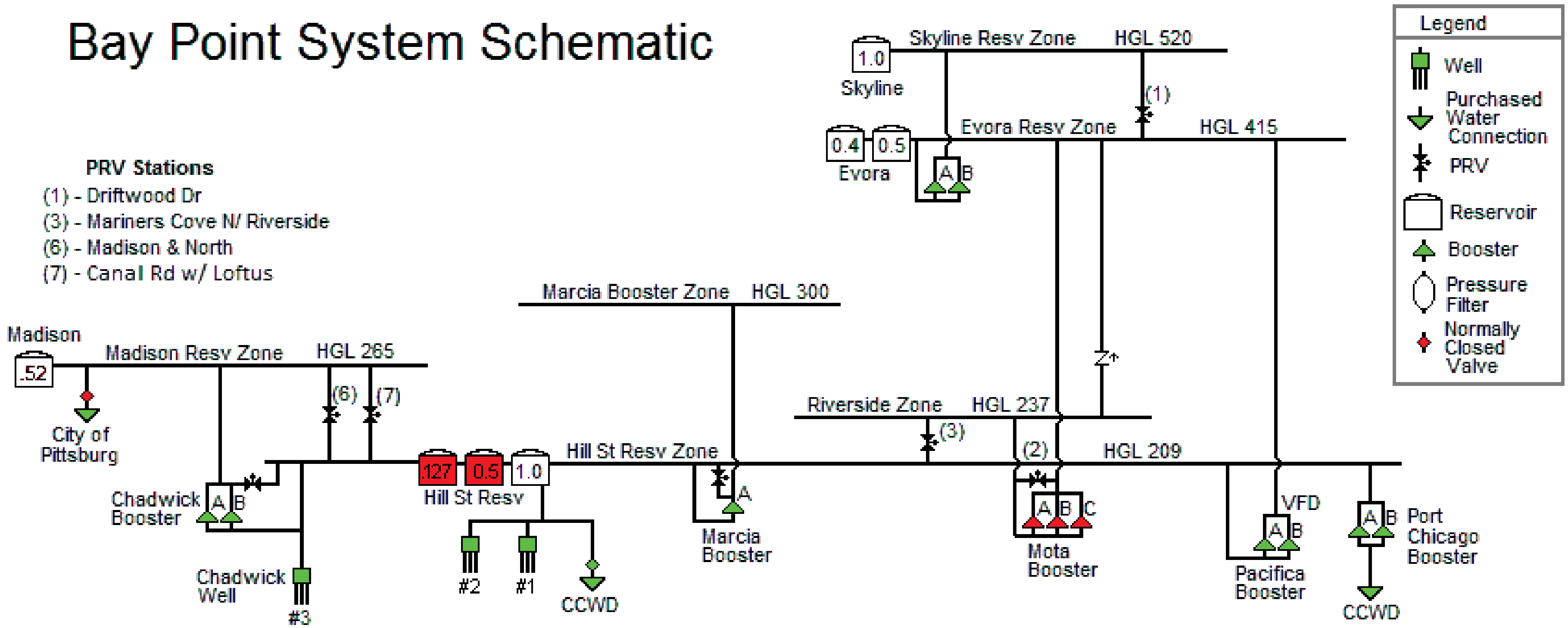


FIGURE 2-2

SYSTEM SCHEMATIC

GSWC REGION I MASTER PLAN

BAY POINT SYSTEM

Golden State Water Company

A Subsidiary of American States Water Company

SECTION 3

Existing and Future Water Demands

This section documents existing and future water demands for the system and contains the following information:

- Demand definitions and scenarios
- Existing demands
- Peaking factors
- Future demand projections

3.1 Demand Definitions and Periods

Demand is classified in two basic ways:

- Demand: The total quantity of water required for a given period of time to meet the water system's various uses. These uses may include residential, commercial, industrial, and other revenue and non-revenue demands.
- Non-revenue water: The difference between the total amount of water produced from water supply sources and the total amount of water delivered to customers. This includes water used for firefighting, flushing, water lost due to system leaks and illegal connections. For systems without meters for all customers, this demand classification may not be quantifiable.

The water industry commonly uses several demand periods for developing water distribution system master plans. These demand periods are designated as average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day demand plus fire flow (MDD+FF), and were applied as necessary to evaluate the system. The American Water Works Association (AWWA, 2005) defines these common steady-state demand periods as follows:

- ADD: Total amount of water delivered to the system in 1 year divided by 365 days.
- MDD: Maximum amount of water delivered to the system in any single day of the year.
- PHD: Amount of water required to meet peak demands during MDD. GSWC applies PHD for four hours when analyzing system supply and storage.
- MDD+FF: Amount of water required to fight a fire in addition to MDD.

3.2 Existing Demands

The existing demands represent a baseline for evaluating the existing system and to project future demands. The data used to develop the existing demands was based on historical water production data provided by GSWC.

3.2.1 Historical Water Use

For this master plan, it was assumed that the historical water production equaled the historical water demand (including non-revenue water). TABLE 3-1 summarizes historical annual water production from 2009 through 2018. The average water demand per connection for this period was 0.394 acre-feet per year per connection (AFY/conn.).

TABLE 3-1 Historical Annual Water Production

Year	Active Service Connections	Total Demand (AFY)*	Average Demand per Connection (AFY/conn.)
2009	4,749	2,317	0.488
2010	4,806	2,190	0.456
2011	4,903	2,165	0.442
2012	4,914	2,034	0.414
2013	4,938	2,081	0.422
2014	4,978	1,874	0.377
2015	5,014	1,635	0.326
2016	5,019	1,675	0.334
2017	5,081	1,737	0.342
2018	5,095	1,724	0.338
10-year average			**0.394**

* Includes non-revenue water use

FIGURE 3-1 summarizes the historical annual water production and number of active service connections. The figure demonstrates a correlation between the number of active service connections and the amount of water consumed. The average demand per connection varied between 0.326 and 0.488.

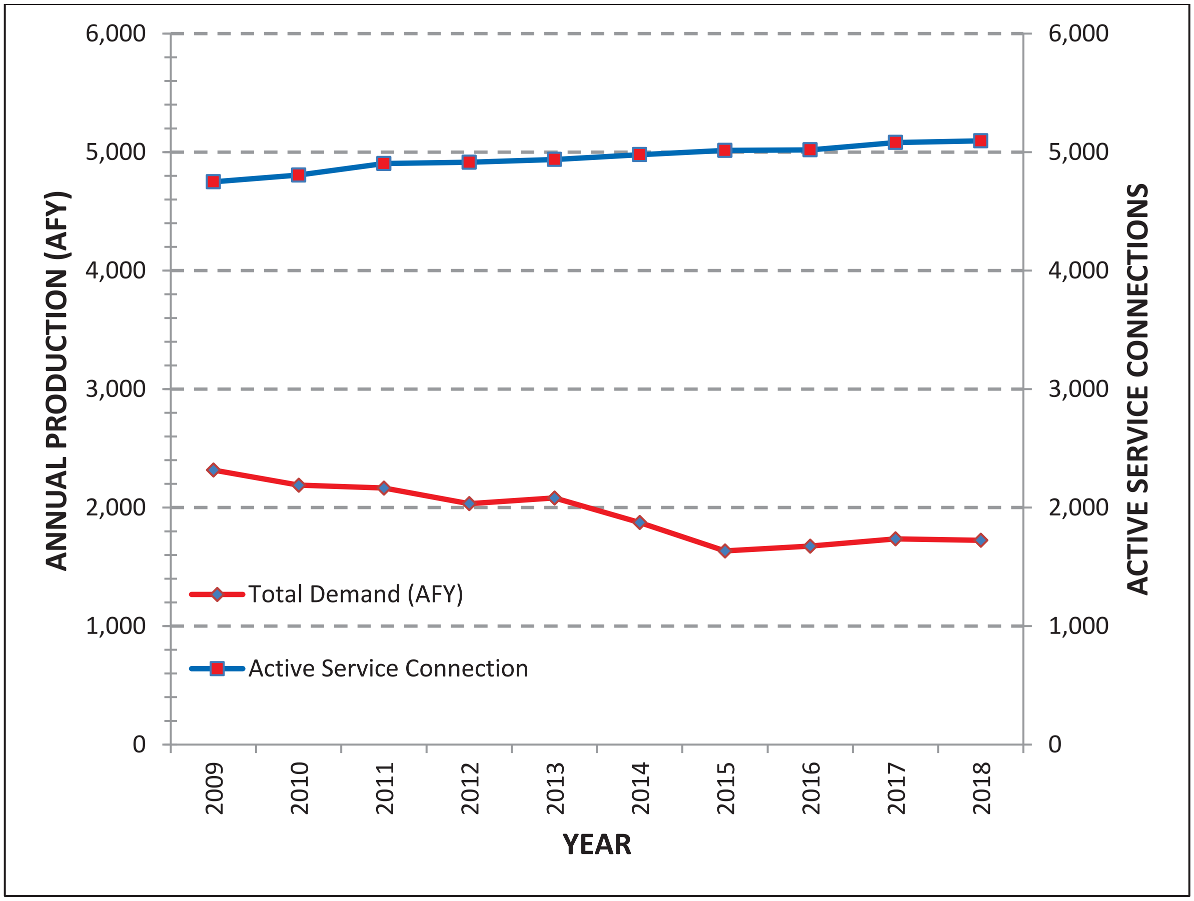


FIGURE 3-1 Historical Annual Production Totals and Active Service Connections for the Last 10 Years

3.2.2 Establishing Demands

The total water demand for existing conditions was estimated by multiplying the number of 2018 active service connections (5,095) with the 10-year average of the average demand per service connection (0.394 AFY/conn.), resulting in a system water demand of 2,006 AFY. Converting the system water demand to a daily demand produces an ADD of 1,243 gpm. This approach allows the calculation of ADD for various planning years, including the impact on anticipated growth, and then allows a direct calculation for other demand periods using the appropriate peaking factor.

To evaluate the system's performance during the MDD scenario, existing historical demand data were used in accordance with the Waterworks Standards set forth by the California Code of Regulations (2009). Section 64554.30 of the Waterworks Standards define MDD as "the amount of water utilized by customers during the highest day of use (midnight to midnight), excluding fire flow, as determined pursuant to Section 64554." Section 64554(b)(1) of the Waterworks Standards states "…identify the day with the highest usage during the past ten years to obtain MDD…". While GSWC is currently unable to track customer usage over an exact 24-hour period, GSWC does record daily water production – and, as stated in Master Plan Section 3.2.1, above, it can be "assumed that the historical water production equal[s] the historical water demand". However, because the daily production reads are not taken at midnight or always collected at the same time each day, the resulting data may be for time periods that can range anywhere from 16 to 32 hours (depending on the time of day the production data are collected). For example, the readings may be taken at 9am one day and 4pm the next; this introduces the chance of a fairly large error if only the recording for a single day is used, as it could include water production over a period longer than 24 hours. To address the possible variations in the hours per day within a given production read, GSWC identifies and uses the average of the three consecutive days with the highest production for each calendar year. By utilizing the average of these highest three consecutive days of water production, the resulting number is normalized, reducing the effect of any imprecision due to the time of day when the data was collected.

Table 3-2 presents the ADD, MDD, and peaking factor data over the last ten years.

TABLE 3-2 Historical Average and Maximum Day Demand

Year	ADD[a]		MDD[b] (gpm)	MDD Peaking Factor (MDD:ADD)
	AFY	gpm		
2009	2,317	1,436	2,044	1.42
2010	2,190	1,357	1,969	1.45
2011	2,165	1,342	1,824	1.36
2012	2,034	1,261	1742	1.38
2013	2,081	1,290	1,863	1.44
2014	1,874	1,162	1,608	1.38
2015	1,635	1,013	1,284	1.27
2016	1,675	1,038	1,557	1.50
2017	1,737	1,077	1,550	1.44
2018	1,724	1,069	1,564	1.46

[a] Includes non-revenue water use
[b] Average of three consecutive highest days

Peaking factors are typically calculated as a ratio of the demand period to ADD. For example, to determine the MDD peaking factor you would divide the MDD by the ADD. Peaking factors are used to estimate future water demands as presented and discussed in Section 3.3. To determine the existing MDD, the Waterworks Standards state the following in Section 64554(b):

> *A system shall estimate MDD and PHD for the water system as a whole (total source capacity and number of service connections) and for each pressure zone within the system (total water supply available from the water sources and interzonal transfers directly supplying the zone and number of service connections within the zone), as follows:*
>
> *(1) If daily water usage data are available, identify the day with the highest usage during the past ten years to obtain MDD; determine the average hourly flow during MDD and multiply by a peaking factor of at least 1.5 to obtain PHD.*

According to TABLE 3-2, the highest MDD during the past ten years was 2,044 gpm, which occurred in 2009. Multiplying the MDD by a peaking factor of 1.5 results in a PHD of 3,066 gpm. It has been GSWC's experience that utilizing a peaking factor of 1.5 has been sufficient to meet PHD. Projected system demands for the ADD, MDD, and PHD scenarios are summarized in TABLE 3-3.

TABLE 3-3 Projected System Demands by Demand Period

Demand Period	GPM
ADD	1,243
MDD	2,044
PHD	3,066

3.3 Future Demand Projections

Future demands were projected first to estimate future ADD, and then peaking factors were applied to estimate MDD and PHD. The following sources of data and approaches were used:

- Growth-rate projections
- Water-demand projections

3.3.1 Growth Rate Projections

Growth rate projections were obtained from the 2015 Urban Water Master Plan (UWMP) for the Bay Point System, and were based on estimates of the number of future service connections. The UWMP methodology used year 2010 U.S. Census data to correlate population growth with the increase in service connections. This correlation was then used to determine future water demand.

3.3.2 Water Demand Projections

The projected annual water demands were obtained from the 2015 UWMP for the Bay Point System and are based on the projected number of service connections. A factor for average water demand per connection was then applied, and state-mandated SBX7-7 reductions taken into account.

FIGURE 3-2 presents the historical and projected annual water demands, including the most recent 10-year period. Projections of future demands are slightly higher than the existing demand (2019) of 2,006 AFY.

The State of California is in a long term drought and the Governor has issued Executive Orders that will likely result in significant reductions in future demands. This Master Plan utilizes the current requirements established by the State of California and California Public Utilities Commission in evaluating needed facilities but acknowledges that the requirements may change. Subsequent updates to this Master Plan will reflect future changes in requirements.

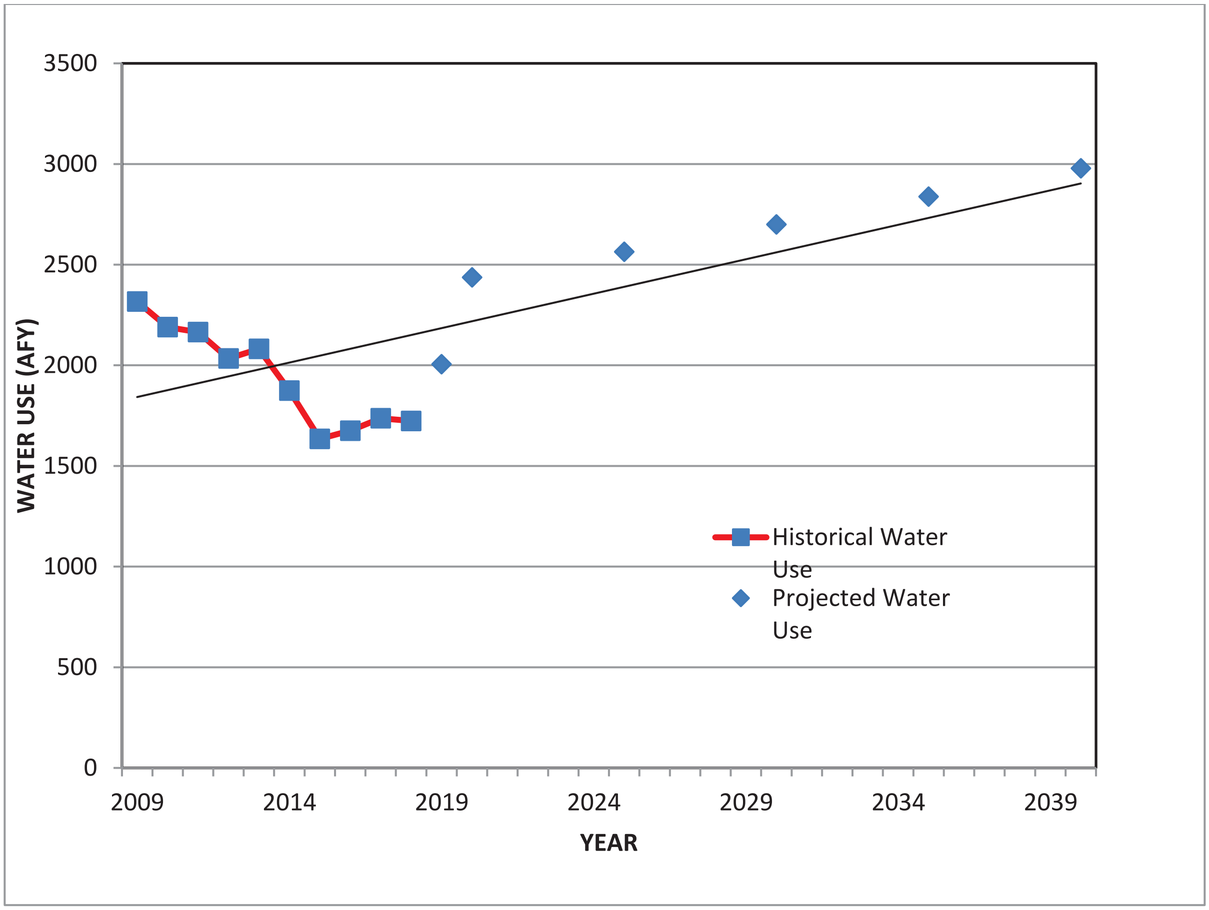


FIGURE 3-2 Historical Water Demand and Future Water Demand Projections

The water demands for 2040 project to be 2,979 AFY, resulting in an ADD of 1,848 gpm. To determine the projected MDD for year 2040, a peaking factor from TABLE 3-2 was applied to the projected ADD. The peaking factor associated with the highest MDD during the past ten years, 1.42 in 2009, was selected, resulting in a MDD of 2,623 gpm. A peaking factor of 1.5 was multiplied by the projected MDD to determine the projected PHD, which is 3,935 gpm. TABLE 3-4 summarizes the projected demands for ADD, MDD, and PHD periods.

TABLE 3-4 Water System Demands by Demand Period

	Demand Period and Peaking Factor			
Planning Year	**Annual Average (AFY)**	**ADD (gpm)**	**MDD (gpm)**	**PHD (gpm)**
2020	2,437	1,511	2,146	3,219
2040	2,979	1,848	2,623	3,935

SECTION 4

Hydraulic Model Development and Calibration

4.1 Overview

A computerized hydraulic model of a water distribution system is an important tool used as part of the Water Master Plan to conduct hydraulic analyses of the water system.

The computer model is used to analyze the facilities, operational characteristics, and water supply and consumption data of a water system. The water distribution system hydraulic model includes pipes, junction nodes (connection points for pipes and location of demands), valves, wells, pumps, purchased water connections, tanks, and reservoirs. Operational characteristics include parameters that control the method by which the water is distributed through the system, such as on and off settings for pumps, pressure or flow controls for hydraulically actuated valves, or main line valve closures. Data for supply and consumption determine where the water supply and demands are applied within the modeled distribution system.

Accurate computer model development begins with entering the correct information into the data file and calibrating the model to match existing conditions in the field. Once this foundation is complete, the resulting model becomes an invaluable tool. It can simulate the existing and future water system, identify system deficiencies, analyze impacts from increased demands, and determine the effectiveness of proposed improvements.

4.2 Construction and Calibration of the Hydraulic Computer Model

The Bay Point System hydraulic computer model was revised as part of the 2016 Master Plan. For this Master Plan, the model was checked for accuracy and updated to include newly constructed facilities. Valve settings for pressure regulating valves were also verified, and the system demands were validated. Localized calibration was performed to refine the model in certain sections of the system.

4.3 Summary

This Master Plan update included verification of the physical components represented in the hydraulic model, validation of demands in the model, and localized field testing and calibration.

It is important to note that model calibration for any water system is an ongoing effort. As changes in the system occur from changing demands, new infrastructure development, or changing operational settings, the model must be periodically updated and checked to ensure agreement with field measurements. This update serves as a baseline for future calibration efforts by GSWC.

SECTION 5

Supply and Storage Capacity Evaluation

This section documents the evaluation of the water supply and storage capacity for the Bay Point System. The evaluation results accomplished the following:

- Established storage needs for each pressure zone and the entire distribution system
- Identified supply and/or storage deficiencies in the existing and future systems
- Proposed improvements that mitigate the deficiencies identified

In each subsection, the supply and storage capacity of the existing and future water systems were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and facilities were proposed to mitigate the deficiency.

5.1 Overview

To provide a reliable water supply, a water system must be able to meet the system demands under a variety of conditions. The water supplied may be provided by a combination of supply sources, or stored water, or both. The specific demand period being analyzed may limit the source of water for the scenario. For example, stored water should not be used to meet ADD or MDD but could be used for PHD or MDD+FF. Therefore, each demand period may require a different ratio of water supplies and storage. This analysis examines various demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage.

5.2 Evaluation Approach

This supply and storage capacity analysis examined the Bay Point System under two planning periods:

- **Existing (2019) system.** The demands for the existing water system were determined by multiplying the 10 year historical average demand per connection and the most recent number of connections (year 2018) to obtain the total system demand. The analyses assumed all facilities that were operational in 2019.

- **2040 system.** The long-term planning horizon (2040) water system analysis assumed 2040 demands (assumed buildout) and facilities included in the existing system analysis plus facilities needed to correct deficiencies in 2040.

5.2.1 Analysis Criteria

The Bay Point System must be capable of providing sufficient water supply and storage capacity to meet the minimum criteria summarized in TABLE 5-1. These criteria were extracted from the technical memorandum titled *Master Planning Criteria and Standards*.

The criteria apply to the system as a whole and to each pressure zone in the system. For planning purposes, this Master Plan utilizes the Planning Scenario 'MDD + Fire Flow' to analyze the system performance under a worst-case planning scenario. The worst-case planning scenario is represented by applying the single most stringent fire flow requirement established (based on land use plans or as designated by the local fire jurisdiction) for a structure within a hydraulic zone or planning area as the baseline fire flow requirement for the entire hydraulic zone or planning area. For the purposes of the planning analysis, this is considered a goal rather than a requirement. If the result of the worst case planning scenario indicates a deficiency in MDD + Fire Flow, it should be noted that there may not be a deficiency in the actual fire flow requirement for a particular structure, but rather that GSWC is not meeting the planning goal for the overall hydraulic zone or planning area.

TABLE 5-1 Supply and Storage Capacity Analysis Criteria

Planning Scenario	Demand and Duration	Evaluation Criterion	Storage Usage	Facilities Assumed to be Out of Service
Average day	ADD for 24 hours	Total capacity	No storage drawdown	-
Maximum day	MDD for 24 hours	Firm capacity	No storage drawdown	Largest pumping unit in system
Peak hour	PHD for 4 hours[1]	Firm capacity	Operational storage	Largest pumping unit in system
MDD + fire flow	MDD plus fire flow, duration varies[2]	Total capacity	Fire storage	-
Planned CCWD outage	ADD for 7 days	Total capacity without most critical CCWD connection or pipeline	Operational and emergency storage	Largest CCWD connection or pipeline
Unplanned CCWD outage	MDD for 1 day followed by ADD for 6 days	Total capacity without most critical CCWD connection or pipeline	Operational and emergency storage	Largest CCWD connection or pipeline

[1] Operational storage required to meet peak demands during MDD was defined as the supply needs during 4 hours of PHD.
[2] Fire flow scenarios are based on fire agency maximum flow requirements for a single structure within a planning area and are applied throughout the planning area as part of the planning analysis. Actual fire flows may be less than the maximum fire flow used for planning analysis.

It is worth noting that the California Public Utilities Commission (CPUC) and State Water Resources Control Board, Division of Drinking Water (DDW) currently provide no specific requirements for storage volume. Therefore, recommended standards published by the American Water Works Association (AWWA) were considered in the development of the storage criteria used in this master plan.

5.2.2 Storage

In addition to providing adequate water supplies for the water consumers, water distribution systems often rely on stored water within the distribution system to provide the following operational benefits:

- Help equalize fluctuations between supply and demand.
- Supply sufficient water for firefighting.
- Meet demands during an emergency or unplanned outage of a major supply source.

AWWA defines three types of storage: operational, fire, and emergency. The amount of storage required for each of these types varies by system. Nevertheless, all three types of storage must be considered. In some cases, water stored in the groundwater basin can provide some of this storage. However, when the stored water does not flow by gravity and requires pumping, sufficient pumping redundancy and stand-by power generators must be provided if the storage source is to be considered reliable.

This analysis evaluates the ability of the system's storage facilities to meet the water system's storage requirements. The resulting volume must be allocated to the pressure zones where the demands exist, or to a neighboring zone (if there are pressure-regulating stations or check valves available that allow the water to flow into the neighboring zone). The water system must also be evaluated to determine if existing booster stations provide sufficient water to be pumped into the higher-pressure zones.

TABLE 5-2 presents the recommended operational, fire, and emergency storage criteria as defined by GSWC for the Bay Point System.

TABLE 5-2 Criteria for Calculating Storage

Storage Category	GSWC Criteria
Operational	Storage volume to meet PHD in addition to MDD supply
Fire	Maximum recommended fire storage volume in the system
Emergency	ADD for 12 hours

Operational Storage

The required volume of water for operational storage is determined by the volume needed for regulating the difference between the rate of supply and the daily variations (peaks) in water usage. This difference results in the lowest and highest operating levels in the reservoirs under normal conditions. The resulting volume must be allocated to either the pressure zone (where the demands exist) or to a higher-pressure zone (for use by the lower-pressure zone).

Fire Storage

The volume of water required for firefighting is a function of the instantaneous flow rate required to fight the fire over the duration of the fire flow event as determined by the local fire jurisdiction. Consideration is also made to evaluate the number of fire flow events that may occur before the volume can be replenished. Further, the volume of water necessary to fight a fire can be provided from water supply, water storage, or a combination thereof. For planning purposes, it is desirable and conservative to design the water system to have capacity within water tanks for the volume of water needed for firefighting; however, the fire storage in the tanks plus available supply in excess of MDD can be utilized to meet firefighting requirements. The fire-flow requirements listed in TABLE 5-3 were used to establish the flow rate and duration for each pressure zone; these criteria were used to identify the largest volume of water required for firefighting within each pressure zone (based on the land use in that zone and the flow rates and durations from TABLE 5-3). The resulting fire-flow volumes are shown in TABLE 5-3.

TABLE 5-3 Fire Storage Volumes

Land Use Category	Minimum Fire Flow Required (gpm)	Duration (hr)	Recommended Fire Storage Volume (MG)
Residential	750	2	0.09
Intermediate/elementary school	1,500	2	0.18
Public facilities, high school	1,500	3	0.27
Commercial/Industrial	2,000	3	0.36
Calvary Temple church	2,000	4	0.48

MG: million gallons

For the Bay Point System, it was assumed that only one fire event within the system would occur before storage tanks could recover. The lowest fire-flow volume (0.09 MG) is the result of a 750-gpm fire for duration of 2 hours (single-family residential land use). The largest fire-flow volume (0.48 MG) is the result of a 2,000-gpm fire for a duration of 4 hours (industrial use).

Emergency Storage

Emergency storage is a dedicated source of water that can be used as a backup supply in the event a major supply source is interrupted. This can be provided by water from a second independent source, by water stored in reservoirs, or a combination of both. *Ten States Standards* recommends that emergency storage total between 12 and 24 hours of ADD volume. Because the Bay Point System contains multiple supply sources and a storage reservoir, 12 hours of ADD volume for this system is appropriate.

5.3 Existing System Evaluation

Evaluation of the existing system's supply and storage capacity involved analysis of key system facilities to identify supply or storage capacity deficiencies. This approach involved analyzing multiple proposed improvement alternatives to address these deficiencies. These proposed improvements were then evaluated to determine the most cost-effective alternatives, which would then be identified as the recommended improvements and incorporated into the CIP. The following subsections describe the existing system evaluation:

- Water demands for each demand period
- Supply facilities
- Storage facilities

- Capacity analysis
- Proposed improvements to address deficiencies in the existing system

5.3.1 Existing System Water Demands for Each Demand Period

TABLE 5-4 defines the existing demands by pressure zone for each demand period, based on spatial demand allocation from the Bay Point GIS.

TABLE 5-4 Existing System Water Demands

Pressure Zone	ADD (gpm)	MDD (gpm)	PHD (gpm)	Demand by Zone (%)
Marcia Booster Zone	7	12	17	<1
Madison reservoir Zone	60	99	149	5
Hill Street Reservoir Zone	977	1,606	2,409	79
Riverside Zone	28	46	69	2
Skyline Reservoir Zone	13	22	32	1
Evora Reservoir Zone	158	260	389	13
Total	**1,243**	**2,044**	**3,066**	**100**

5.3.2 Existing System Supply Facilities

The existing water supply facilities in the Bay Point System were identified in Section 2, Existing Water System Facilities. TABLE 5-5 summarizes the design production capacity of each supply source and systemwide totals for total capacity and firm capacity.

TABLE 5-5 Existing System Supply Facilities

Facility Name	Source	Pressure Zone	Total Capacity (gpm)
Hill Street Well #1a	Groundwater	Hill Street Zone	125
Hill Street Well #2	Groundwater	Hill Street Zone	88
Chadwick Well #3	Groundwater	Hill Street Zone	45
Port Chicago CCWD[b]	Purchased Water	Hill Street Zone	1,017
Hill Street CCWD	Purchased water	Hill Street Zone	4,070
Main Zone total			**5,345**
Systemwide total			**5,345**

[a] This supply source represents the largest capacity facility in the system and is therefore assumed to be unavailable for firm capacity.
[b] Actual total capacity is the lesser of: 1) GSWC's 1994 Agreement with CCWD for the Port Chicago Interconnection; or 2) the booster capacity of the plant, as Port Chicago CCWD water is re-boosted before entering the distribution system. For further detail, see Tables 2-4 and 2-7.

5.3.3 Existing System Storage Facilities

The existing storage facilities in the Bay Point System are described in Section 2, Existing Water System Facilities. TABLE 5-6 summarizes the storage facilities for the Bay Point System.

TABLE 5-6 Existing System Storage Facilities

Facility Name	Primary Pressure Zone Served	Total Capacity (MG)
Evora Reservoir #1	Evora Reservoir Zone (pumped to Skyline Reservoir Zone)	0.40
Evora Reservoir #2	Evora Reservoir Zone (pumped to Skyline Reservoir Zone)	0.50
Hill Street Reservoir #3	Hill Street Reservoir Zone	1.00
Madison Reservoir	Madison Reservoir Zone	0.52
Skyline Reservoir	Skyline Reservoir Zone	1.00
Total storage capacity		**3.42**

5.3.4 Existing System Supply and Capacity Analysis

This analysis of the existing water distribution system evaluated the six pressure zones separately and then the system as a whole to verify that adequate supply and storage facilities were available. The analysis reviewed the demand periods (ADD, MDD, PHD, MDD+FF and both planned and unplanned CCWD outages); the duration for each demand period is detailed in TABLE 5-1. The duration of MDD+FF was established by the fire-flow criteria identified in TABLE 5-3.

In the following subsections, an analysis is performed for each pressure zone and for the overall system. The demands and production capacities for each zone are presented in a table that summarizes the results. These tables present the demands for each demand period in the zone and for any zones that depend on this zone for supplies. These demands are presented as a flow rate and are converted into a demand volume using the duration for the demand period. For example, a demand of 100 gpm for ADD would be equal to a demand volume of 144,000 gallons, given that the duration of ADD is 24 hours.

Available supplies are presented below the demand volume totals. Available supplies include water supply sources, booster pumping capacity, and stored water. Stored water was not used to provide water supplies during ADD or MDD. Stored water that was allocated as operational storage was assumed to be available for PHD, and water stored for fire flows was assumed to be available for MDD+FF. The total supplies were assumed to be available for ADD and MDD+FF. For the purpose of assuring reliable water service is provided to customers, each zone's ability to meet MDD and PHD with firm capacity was analyzed. (Firm capacity was defined as the available capacity with the largest pumping unit out of service.) The available production was calculated by converting flow rates into a production volume (using the duration of the demand period) and adding the available storage volume.

The last two lines of the table compare the system's available production capacity to the demands for the same duration. Where production capacity exceeds demands, the row *supply minus demand* will be positive. This indicates an adequate combination of supplies and storage. Where this occurs, the last row of the table, *supply meets demand*, will contain *yes*. However, if demands exceed production, then the row *supply minus demand* will have a negative value, and the row *supply meets demand* will contain *no*. In this latter case, proposed improvements were evaluated to correct the deficiency.

Hill Street Reservoir Zone Analysis

Water supply to the Hill Street Reservoir Zone is provided by three active wells and the Hill Street CCWD connection, as listed in TABLE 5-5. There is 1.0 MG storage in this pressure zone from Hill Street Reservoir 3. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.36 MG) was assumed.

The overall capacity analysis for the Hill Street Reservoir Zone is presented in TABLE 5-7.

TABLE 5-7 Existing System Supply and Capacity Analysis—Hill Street Reservoir Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Evora Res Zone	BP	199	0.287	328	0.472	490	0.118	328	0.059
Hill Street Res Zone		977	1.407	1,606	2.313	2,409	0.578	3,606	0.649
Madison Res Zone	BP	60	0.086	99	0.143	125	0.030	99	0.018
Marcia Booster Zone	BP	7	0.010	12	0.017	17	0.004	12	0.002
Total Demand		**1,243**	**1.790**	**2,045**	**2.945**	**3,041**	**0.730**	**4,045**	**0.728**
Supply	Capacity								
Wells	258	258	0.372	133	0.192	133	0.032	258	0.046
CCWD	4,070	985	1.418	1,912	2.753	2,908	0.698	3,787	0.682
Boosters	1,400	0	0.000	0	0.000	0	0.000	0	0.000
PRVs	4,010	0	0.000	0	0.000	0	0.000	0	0.000
Reservoirs	1.00	-	-	-	-	0	0.000	0	0.000
Total Supply		**1,243**	**1.790**	**2,045**	**2.945**	**3,041**	**0.730**	**4,045**	**0.728**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		Unplanned Outage - Day 1 (MDD)		Unplanned Outage - Days 2-7 (ADD)	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Evora Res Zone	BP	199	2.006	328	0.472	199	1.719
Hill Street Res Zone		977	9.848	1,606	2.313	977	8.441
Madison Res Zone	BP	60	0.605	99	0.143	60	0.518
Marcia Booster Zone	BP	7	0.071	12	0.017	7	0.060
Total Demand		**1,243**	**12.529**	**2,045**	**2.945**	**1,243**	**10.740**
Supply	Capacity						
Wells	258	258	2.601	258	0.372	258	2.229
CCWD	4,070	0	0.000	0	0.000	0	0.000
Boosters	1,400	985	9.929	1,168	1.682	985	8.510
PRVs	4,010	0	0.000	0	0.000	0	0.000
Reservoirs	1.00	0	0.000	619	0.891	0	0.000
Total Supply		**1,243**	**12.529**	**2,045**	**2.945**	**1,243**	**10.740**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

*The Port Chicago CCWD Interconnection is accounted for via the Port Chicago Boosters (1,400 gpm capacity); no scenarios exceeded 1,017 gpm (the current Interconnection capacity limit per the 1994 Agreement) except for the planned/unplanned CCWD outage scenarios, which utilize the booster capacity for emergency purposes.

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Marcia Booster Zone Analysis

Water supply to the Marcia Booster Zone is provided by one booster from the Hill Street Reservoir Zone, as listed in TABLE 2-7 (a spare booster pump with the same design point is kept in reserve by Bay Point Operations staff, and for purposes of this analysis is considered to be a reliable backup). There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Marcia Booster Zone is presented in TABLE 5-8.

TABLE 5-8 Existing System Supply and Capacity Analysis—Marcia Booster Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		2	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Marcia Booster Zone		7	0.010	12	0.017	17	0.004	762	0.091
Total Demand		**7**	**0.010**	**12**	**0.017**	**17**	**0.004**	**762**	**0.091**
Supply	Capacity								
Boosters	40	7	0.010	12	0.017	17	0.004	40	0.005
Pipelines	750	-	-	-	-	-	-	750	0.090
Total Supply		**7**	**0.010**	**12**	**0.017**	**17**	**0.004**	**790**	**0.095**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**28**	**0.003**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		**Unplanned Outage - Day 1 (MDD)**		**Unplanned Outage - Days 2-7 (ADD)**	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Marcia Booster Zone		7	0.071	12	0.017	7	0.060
Total Demand		**7**	**0.071**	**12**	**0.017**	**7**	**0.060**
Supply	Capacity						
Boosters	40	7	0.071	12	0.017	7	0.060
Pipelines	750	-	-	-	-	-	-
Total Supply		**7**	**0.071**	**12**	**0.017**	**7**	**0.060**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios. For the MDD+FF scenario, fire flow is supplied by a fire hydrant on a parallel pipeline in the Hill Street Reservoir Zone; otherwise the Marcia Booster Zone would have a deficiency of 750 gpm (0.090 MG) for MDD+FF.

Madison Reservoir Zone Analysis

Water supply to the Madison Reservoir Zone is provided by two boosters from the Hill Street Reservoir Zone, as listed in TABLE 2-7. There is 0.52 MG storage in this pressure zone from the Madison Reservoir. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.18 MG) was assumed.

The overall capacity analysis for the Madison Reservoir Zone is presented in TABLE 5-9.

TABLE 5-9 Existing System Supply and Capacity Analysis—Madison Reservoir Zone

		Planning Scenario							
		ADD		MDD		PHD		MDD+FF	
Duration (Hours)		24		24		4		2	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Hill Street Res Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Madison Res Zone		60	0.086	99	0.143	149	0.036	1,599	0.192
Total Demand		**60**	**0.086**	**99**	**0.143**	**149**	**0.036**	**1,599**	**0.192**
Supply	Capacity								
Boosters	250	60	0.086	99	0.143	125	0.030	250	0.030
Reservoirs	0.52	-	-	-	-	24	0.006	1,349	0.162
Total Supply		**60**	**0.086**	**99**	**0.143**	**149**	**0.036**	**1,599**	**0.192**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		Unplanned Outage - Day 1 (MDD)		Unplanned Outage - Days 2-7 (ADD)	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Hill Street Res Zone	PRV	0	0.000	0	0.000	0	0.000
Madison Res Zone		60	0.605	99	0.143	60	0.518
Total Demand		**60**	**0.605**	**99**	**0.143**	**60**	**0.518**
Supply	Capacity						
Boosters	250	60	0.605	99	0.143	60	0.518
Reservoirs	0.52	0	0.000	0	0.000	0	0.000
Total Supply		**60**	**0.605**	**99**	**0.143**	**60**	**0.518**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Riverside Zone Analysis

Water supply to the Riverside Zone is provided by a PRV from the Evora Reservoir Zone, as listed in TABLE 2-8. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Riverside Zone is presented in TABLE 5-10.

TABLE 5-10 Existing System Supply and Capacity Analysis—Riverside Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		2	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Hill Street Res Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Riverside Zone		28	0.040	46	0.066	69	0.017	796	0.096
Total Demand		**28**	**0.040**	**46**	**0.066**	**69**	**0.017**	**796**	**0.096**
Supply	Capacity								
PRVs	1,565	28	0.040	46	0.066	69	0.017	796	0.096
Total Supply		**28**	**0.040**	**46**	**0.066**	**69**	**0.017**	**796**	**0.096**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		**Unplanned Outage - Day 1 (MDD)**		**Unplanned Outage - Days 2-7 (ADD)**	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Hill Street Res Zone	PRV	0	0.000	0	0.000	0	0.000
Riverside Zone		28	0.282	46	0.066	28	0.242
Total Demand		**28**	**0.282**	**46**	**0.066**	**28**	**0.242**
Supply	Capacity						
PRVs	1,565	28	0.282	46	0.066	28	0.242
Total Supply		**28**	**0.282**	**46**	**0.066**	**28**	**0.242**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Skyline Reservoir Zone Analysis

Water supply to the Skyline Reservoir Zone is provided by two boosters from the Evora Reservoir Zone, as listed in TABLE 2-7. There is 1.0 MG storage in this pressure zone from the Skyline Reservoir. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.48 MG) was assumed.

The overall capacity analysis for the Skyline Reservoir Zone is presented in TABLE 5-11.

TABLE 5-11 Existing System Supply and Capacity Analysis—Skyline Reservoir Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		4	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Evora Res Zone	PRV	0	0.000	0	0.000	0	0.000	356	0.085
Skyline Res Zone		13	0.019	22	0.032	32	0.008	2,022	0.485
Total Demand		**13**	**0.019**	**22**	**0.032**	**32**	**0.008**	**2,378**	**0.571**
Supply	Capacity								
Boosters	1,350	13	0.019	22	0.032	32	0.008	1,350	0.324
Reservoirs	1.00	-	-	-	-	0	0.000	1,028	0.247
Total Supply		**13**	**0.019**	**22**	**0.032**	**32**	**0.008**	**2,378**	**0.571**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		**Unplanned Outage - Day 1 (MDD)**		**Unplanned Outage - Days 2-7 (ADD)**	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Evora Res Zone	PRV	0	0.000	0	0.000	0	0.000
Skyline Res Zone		13	0.131	22	0.032	13	0.112
Total Demand		**13**	**0.131**	**22**	**0.032**	**13**	**0.112**
Supply	Capacity						
Boosters	1,350	13	0.131	22	0.032	13	0.112
Reservoirs	1.0	0	0.000	0	0	0	0.000
Total Supply		**13**	**0.131**	**22**	**0.032**	**13**	**0.112**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Evora Reservoir Zone Analysis

Water supply to the Evora Reservoir Zone is provided by two boosters from the Hill Street Reservoir Zone, as listed in TABLE 2-6, and a PRV from the Skyline Reservoir Zone, as listed in TABLE 2-8. There is 0.9 MG storage in this pressure zone from Evora Reservoir 1 and Evora Reservoir 2. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.36 MG) was assumed.

The overall capacity analysis for the Evora Reservoir Zone is presented in TABLE 5-12.

TABLE 5-12 Existing System Supply and Capacity Analysis—Evora Reservoir Zone

		Planning Scenario							
		ADD		MDD		PHD		MDD+FF	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Evora Res Zone		158	0.228	260	0.374	389	0.093	2,260	0.407
Riverside Zone	PRV	28	0.040	46	0.066	69	0.017	46	0.008
Skyline Res Zone	BP	13	0.019	22	0.032	32	0.008	22	0.004
Total Demand		**199**	**0.287**	**328**	**0.472**	**490**	**0.118**	**2,328**	**0.419**
Supply	Capacity								
Boosters	1,300	199	0.287	328	0.472	490	0.118	1,300	0.234
PRVs	1,565	0	0.000	0	0.000	0	0.000	0	0.000
Reservoirs	0.900	-	-	-	-	0	0.000	1,028	0.185
Total Supply		**199**	**0.287**	**328**	**0.472**	**490**	**0.118**	**2,328**	**0.419**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		Unplanned Outage - Day 1 (MDD)		Unplanned Outage - Days 2-7 (ADD)	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Evora Res Zone		158	1.593	260	0.374	158	1.365
Riverside Zone	PRV	28	0.282	46	0.066	28	0.242
Skyline Res Zone	BP	13	0.131	22	0.032	13	0.112
Total Demand		**199**	**2.006**	**328**	**0.472**	**199**	**1.719**
Supply	Capacity						
Boosters	1,300	199	2.006	328	0.472	199	1.719
PRVs	1,565	0	0.000	0	0.000	0	0.000
Reservoirs	0.900	0	0.000	0	0.000	0	0.000
Total Supply		**199**	**2.006**	**328**	**0.472**	**199**	**1.719**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Systemwide Capacity Analysis

In the systemwide analysis, all supply and storage facilities were included. The total existing demands were presented in TABLE 5-4. The total and firm production capacities in TABLE 5-5 and the storage facilities in TABLE 5-6 were used for the appropriate demand periods. The fire flow used for MDD+FF was based on the largest fire flow in the system, a 2,000-gpm fire flow for 4-hour duration.

The results of the systemwide supply and storage analysis for the existing system are summarized in TABLE 5-13.

TABLE 5-13 Existing System Supply and Capacity Analysis—Systemwide

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		4	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		**1,243**	**1.790**	**2,045**	**2.945**	**3,065**	**0.736**	**4,045**	**0.971**
Supply	Capacity								
Wells	258	258	0.372	133	0.192	133	0.032	258	0.062
CCWD	4,070	985	1.418	1,912	2.753	2,908	0.698	3,787	0.909
Boosters	4,340	0	0.000	0	0.000	0	0.000	0	0.000
Reservoirs	3.42	-	-	-	-	24	0.006	0	0.000
Total Supply		**1,243**	**1.790**	**2,045**	**2.945**	**3,065**	**0.736**	**4,045**	**0.971**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		**Unplanned Outage - Day 1 (MDD)**		**Unplanned Outage - Days 2-7 (ADD)**	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Total Demand		**1,243**	**12.529**	**2,045**	**2.945**	**1,243**	**10.740**
Supply	Capacity						
Wells	258	258	2.601	258	0.372	258	2.229
CCWD	4,070	0	0.000	0	0.000	0	0.000
Boosters	4,340	985	9.929	1,168	1.682	985	8.510
Reservoirs	3.42	0	0.000	619	0.891	0	0.000
Total Supply		**1,243**	**12.529**	**2,045**	**2.945**	**1,243**	**10.740**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

*The planned/unplanned CCWD outage scenarios utilize the Port Chicago Boosters (1,400 gpm capacity) for emergency purposes.

The systemwide supply and storage analysis results for the existing system indicate that the existing supply meets the demands for all planning scenarios.

5.3.5 Existing System Storage Analysis

The analysis of the existing storage facilities evaluated the required storage for each pressure zone and compared it to the existing storage available for each zone to determine the storage deficiencies. The benefits of storage and the types of storage (operational, fire, and emergency) are described in more detail in section 5.2.2.

TABLE 5-14 evaluates the three types of storage to calculate the total required storage for each zone and the entire system. The operational storage is calculated by subtracting the MDD from the PHD to obtain the additional flowrate that is required during the PHD scenario. This additional flowrate is multiplied by the duration of PHD and then converted to a volume to determine the required operational storage. A duration of four hours was used to account for the typical duration of peak demands during the day. The fire storage for each zone is based on criteria given in section 5.2.2. In cases where two or more pressure zones retain their fire storage in the same reservoir, that reservoir only needs to contain the fire storage for the zone with the largest recommended fire storage volume. This is because the criteria consider only one fire flow can occur in the system at any given time. To prevent accounting for excess fire storage, pressure zones were given a fire storage total of 0 MG in TABLE 5-14 when fire storage of larger or equal size was used in another zone that retains its fire storage in the same tank. The emergency storage is the volumetric measurement of the ADD over a duration of 12 hours.

Storage deficiencies are identified for each zone in TABLE 5-15. All tanks in the existing system are listed in the left column of the table. All pressure zones in the existing system are listed in the top row of the table. The numbers in the table represent the allotted amount of storage, in millions of gallons, for each zone from each tank. A dash in the table denotes storage from that tank is unavailable for that zone. Zones that are able to utilize storage in a tank, but are not allotted any storage from it are shown in the table as zero. Summing the numbers across the rows results in the total storage volume of the tank listed in the left column of that row. Summing the numbers going down the columns results in the available storage for the zone listed in the top row of that column. The required storage, taken from TABLE 5-14, is given in the row below the available storage. Subtracting the required storage from the available storage within a column results in the excess storage for that column's zone. Negative numbers imply a storage deficiency and are given a "NO" in the adequate storage column. A "YES" in the adequate storage column implies there is adequate storage available for that zone. Fire storage is calculated to supplement supply when the supply is less than the current demand plus fire flow (see Section 5.3.4). Fire storage requirements are planning standards and fire storage is typically only required in times of high demands, supply limitations, and/or emergencies.

TABLE 5-14 Existing System Storage Analysis - Calculated Storage

	Zones						
	Marcia Booster Zone	Madison Reservoir Zone	Hill Street Reservoir Zone	Riverside Zone	Skyline Reservoir Zone	Evora Reservoir Zone	**Systemwide**
Operational							
PHD	17	149	2409	69	32	389	3,066
MDD	12	99	1606	46	22	260	2,044
PHD minus MDD	5	50	803	23	10	129	1,022
Duration	4	4	4	4	4	4	4
MG	0.001	0.012	0.193	0.006	0.002	0.031	0.245
Fire							
GPM	750	1500	2000	750	2000	2000	-
Duration	2	2	3	2	4	3	-
MG*	0.000	0.180	0.000	0.000	0.480	0.000	0.660
Emergency							
ADD	7	60	977	28	13	158	1,243
Duration	12	12	12	12	12	12	12
MG	0.005	0.043	0.703	0.020	0.009	0.114	0.895
Total Recommended Storage	**0.006**	**0.235**	**0.896**	**0.026**	**0.492**	**0.145**	**1.801**

* A fire storage total of zero indicates that fire storage of larger or equal size was used in another zone that receives its fire storage from the same tank.
NOTE: All demand period scenarios (ADD, MDD, and PHD) are given in gallons per minute (GPM). All durations are given in hours. The rows titled "MG" and the total required storage are given in million gallons (MG)

TABLE 5-15 Existing System Storage Analysis - Adequacy Evaluation

	Zones						
	Marcia Booster Zone	Madison Reservoir Zone	Hill Street Reservoir Zone	Riverside Zone	Skyline Reservoir Zone	Evora Reservoir Zone	Total
Madison Reservoir	-	0.520	-	-	-	-	0.520
Hill Street Reservoir 3	-	-	1.000	-	-	-	1.000
Skyline Reservoir	0.006	-	-	0.026	0.968	-	1.000
Evora Reservoir 1	-	-	-	-	-	0.400	0.400
Evora Reservoir 2	-	-	-	-	-	0.500	0.500
Available Storage	0.006	0.520	1.000	0.026	0.968	0.900	3.420
Recommended Storage*	0.006	0.235	0.896	0.026	0.492	0.145	1.800
Available Minus Recommended	0.000	0.285	0.104	0.000	0.476	0.755	1.620
Adequate Storage	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**

* Recommended Storage numbers are from Table 5-14

NOTE: All numbers given are in million gallons (MG)

The existing system storage analysis results indicate no storage deficiency. The overall available storage capacity meets the required storage for the Bay Point System, and excess water can flow by gravity from the Skyline and/or Evora reservoirs to overcome storage deficiencies in the lower pressure zones (Marcia Booster Zone, Hill Street Reservoir Zone, and Riverside Zone).

5.3.6 Proposed Improvements to Address Deficiencies in the Existing System

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the supply and storage evaluation; these are listed in TABLE 5-16. Deficiencies may be corrected by adding supply, storage, or a combination of both. In these cases, the deficiency is shown in both supply (gpm) and storage (MG). The descriptions of the deficiency alternatives are given at the end of TABLE 5-16.

No deficiencies were identified in the supply and storage evaluation.

The numbering system used in TABLE 5-16 is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2035 system. The second number indicates the deficiency number, which starts at 1 and increments by 1 for each deficiency identified. The third number identifies the improvement alternative, but zero is reserved for the deficiency. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system.

TABLE 5-16 Existing System Proposed Supply and Storage Improvements

Deficiency/ Alternative Number	Deficiency/Alternative Description	Pressure Zone	Supply Capacity (gpm)	Storage Capacity (MG)
-	-	-	-	-

5.3.7 Recommended Improvements to Address Deficiencies in the Existing System

Recommended improvements to resolve the deficiencies in the existing system are given in TABLE 5-17. These proposed improvements were recommended for their ability to correct the deficiency and be cost-effective compared to competing alternatives. Refer to the 'Descriptions of Deficiency Alternatives' in section 5.3.6 for more detailed descriptions of proposed improvements. In some cases, the capacity of the proposed improvement is larger than described in the 'Descriptions of Deficiency Alternatives'. This was necessary in order to resolve multiple deficiencies.

TABLE 5-17 Existing System Recommended Supply and Storage Improvements

Alternative Number	Alternative Description	Deficiencies Resolved	Supply/Storage Capacity
-	-	-	-

5.4 2040 System Evaluation

Analysis of the water system for the year 2040 was performed to identify long-term improvements needed for the water system at buildout. This analysis included the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Planned improvements to address existing system deficiencies plus the post-2016 improvements are operational.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

5.4.1 2040 System Water Demands for Each Demand Period

TABLE 5-18 defines the 2040 demands for the Bay Point System. The demands are not provided for each pressure zone because it is unknown how much each zone's demands will increase by the year 2040.

TABLE 5-18 2040 System Water Demands

	ADD (gpm)	MDD (gpm)	PHD (gpm)
Systemwide	1,848	2,623	3,935

5.4.2 2040 System Supply Facilities

The supply facilities for the 2040 system include all supply facilities in the existing system along with all recommended supply facilities to resolve the existing system's deficiencies. TABLE 5-19 summarizes the supply for the 2040 System.

TABLE 5-19 2040 System Assumed Supply Facilities

Facility Name	Total Capacity (gpm)
Additional facilities in the 2040 System	0
Existing supply – Wells	258
Existing supply – CCWD	5,087
Total production capacity for 2040	**5,345**

5.4.3 2040 System Storage Facilities

The storage facilities for the 2040 system include all storage facilities in the existing system along with all recommended storage facilities to resolve the existing system's deficiencies. TABLE 5-20 summarizes the storage for the 2040 System.

TABLE 5-20 2040 System Assumed Storage Facilities

Facility Name	Primary Pressure Zone Served	Total Capacity (MG)
Recommended storage facilities	Hill Street Reservoir Zone	0
Existing storage	Systemwide	3.42
Total storage capacity		**3.42**

5.4.4 2040 System Capacity Analysis

The supply analysis for the 2040 system uses the 2040 projected demands and includes the recommended 2040 supply improvements to analyze system deficiencies. An analysis is not given for each pressure zone because it is unknown how much each zone's demands will increase by year 2040. The supply analysis is given in TABLE 5-21.

TABLE 5-21 2040 System Supply and Capacity Analysis—Systemwide

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		4	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		**1,848**	**2.660**	**2,623**	**3.778**	**3,935**	**0.944**	**4,623**	**1.110**
Supply	Capacity								
Wells	258	258	0.372	131	0.189	131	0.031	258	0.062
CCWD	4,070	1,590	2.290	2,492	3.589	3,804	0.913	4,070	0.977
Boosters	4,340	0	0.000	0	0.000	0	0.000	295	0.071
Reservoirs	3.42	-	-	-	-	0	0.000	0	0.000
Total Supply		**1,848**	**2.661**	**2,623**	**3.778**	**3,935**	**0.944**	**4,623**	**1.110**

Supply Minus Demand	**0**	**0.001**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand	**YES**		**YES**		**YES**		**YES**	

		Planning Scenario					
		Planned CCWD outage		**Unplanned Outage - Day 1 (MDD)**		**Unplanned Outage - Days 2-7 (ADD)**	
Duration (Hours)		168		24		144	
Demand		GPM	MG	GPM	MG	GPM	MG
Total Demand		**1,848**	**18.623**	**2,623**	**3.778**	**1,848**	**15.963**
Supply	Capacity						
Wells	258	258	2.601	258	0.372	258	2.229
CCWD	4,070	0	0.000	0	0.000	0	0.000
Boosters	4,340	1,400	14.112	1,400	2.016	1,400	12.096
Reservoirs	3.42	190	1.911	1,033	1.488	190	1.638
Total Supply		**1,848**	**18.623**	**2,691**	**3.875**	**1,848**	**15.963**
Supply Minus Demand		**0**	**0.000**	**68**	**0.097**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**	

The systemwide supply and storage analysis results for the 2040 system indicate that the supply meets the demands for all planning scenarios.

5.4.5 2040 System Storage Analysis

The storage analysis for the 2040 system uses the 2040 projected demands and includes the recommended supply and storage improvements for the existing system to analyze system deficiencies. Like the 2040 supply analysis, each pressure zone is not analyzed because it is unknown how much each zone's demands will increase by year 2040. The storage analysis is given in TABLE 5-22.

TABLE 5-22 2040 System Storage Analysis

Scenario		**Systemwide**
Operational	PHD	3,935
	MDD	2,623
	PHD minus MDD	1,312
	Duration	4
	MG	0.315
Fire	GPM	2,000
	Duration	4
	MG*	0.480
Emergency	ADD	1,848
	Duration	12
	MG	1.330
Total Recommended Storage		2.125
Available Storage in 2040		3.420
Available minus Recommended		1.295
Adequate Storage		YES

The 2040 system storage analysis results indicate no storage deficiency.

5.4.6 Proposed Improvements to Address Deficiencies in the 2040 System

No deficiencies were identified for the 2040 system, as shown in TABLE 5-23.

TABLE 5-23 2040 System Proposed Supply and Storage Improvements

Deficiency/ Alternative Number	Deficiency/Alternative Description	Pressure Zone	Supply Capacity (gpm)	Storage Capacity (MG)
-	-	-	-	-

5.4.7 Recommended Improvements to Address Deficiencies in the 2040 System

No deficiencies were identified for the 2040 system, as shown in TABLE 5-24.

TABLE 5-24 2040 System Recommended Supply and Storage Improvements

Alternative Number	Alternative Description	Deficiencies Resolved	Supply/Storage Capacity
-	-	-	-

5.5 Summary of Proposed Supply and Storage Improvements through 2040

According to the supply and capacity analysis results in this Master Plan, the following additional supply is necessary to meet future demands:

- Existing system: no additional supply
- 2040 system: no additional supply

According to the storage analysis results in this Master Plan, the following additional storage is necessary to meet future demands:

- Existing system: no additional storage
- 2040 system: no additional storage

No storage or supply deficiencies were identified for the existing system or the 2040 system.

The supply and storage improvements planned by GSWC and analyzed in these evaluations are further examined in Section 6, Hydraulic Analysis and Evaluation. The hydraulic analysis helps determine the optimal configuration of improvements to provide maximum operational and cost benefit, and any resulting recommended improvements are incorporated into the CIP.

SECTION 6

Hydraulic Analysis and Evaluation

This section documents the hydraulic analysis and evaluation results for the Bay Point System. The hydraulic analysis used the calibrated computer model to evaluate the existing water system. This analysis and evaluation accomplished the following tasks:

- Summarized the criteria for the hydraulic analysis
- Performed simulations for various demand conditions and demand periods
- Analyzed the modeling results to identify deficiencies
- Analyzed various proposed improvements to investigate ways to mitigate these deficiencies
- Developed a list of recommended improvements that provide a cost-effective means to correct deficiencies

In following sections, the hydraulic analysis results of the existing water system were compared with the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and improvements were proposed to mitigate the deficiency.

6.1 Overview

Hydraulic analyses of networked water distribution systems are most efficiently performed with the aid of hydraulic computer models and specialized software that perform the numerical analysis. The hydraulic computer model assists with measuring system performance, analyzing operational improvements, and developing a systematic method of determining the size and timing required for new facilities. The model can be used to analyze existing water systems, future water systems, and the effect of specific improvements. By analyzing numerous planning scenarios relatively quickly and easily, the model provides answers to several "what if" questions. The computer program analyzes all of the information in the system data file and generates results in terms of pressures, flow rates, and operating status. The key to successfully using the computer model is correct interpretation of these results, and understanding how the water distribution system was affected.

6.2 Analysis Approach

This hydraulic analysis examined the Bay Point System for only one planning period:

- **Existing (2019) system.** The existing water system analyses assumed 2019 demands, as described in Section 3, and facilities that were operational in 2019.

The demands used in this hydraulic analysis are the same as used for the supply and storage capacity analysis in Section 5.

6.2.1 System Performance Criteria

Hydraulic analysis of the water system involved the use of a computer model that was developed specifically for the Bay Point System and calibrated to conditions observed in the field (see Section 4, Hydraulic Model Development and Calibration). This computer model was used to identify hydraulic deficiencies under the existing planning scenario. Hydraulic model simulations were developed to analyze demand periods (ADD, MDD, PHD, and MDD+FF) to determine whether the system could meet the performance objectives identified for this master plan. These criteria are summarized in TABLE 6-1.

TABLE 6-1 Hydraulic Analysis Criteria

Demand Period	Pipeline Criteria[a]	Pressure Criteria[b]
ADD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
MDD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
PHD	Velocity less than 10 fps	Greater than 30 psi and less than 125 psi
MDD + fire flow	Velocity less than 10 fps	Greater than 20 psi

[a] If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement due to hydraulic deficiencies alone.
[b] Pressure criteria apply only at service connections.

6.2.2 Fire-flow Requirements

In addition to providing adequate water supply and pressure to serve residential, commercial, and industrial water demands placed on the system, the water system must also deliver an adequate supply for firefighting. Since fires can occur at any time, the water system must be ready to provide the required flow at all times with an adequate residual pressure. The water system should be capable of providing the fire flows during an MDD period (MDD+FF), which represents the day of the year having the highest water demands.

To determine the system's capacity to provide adequate fire flows, it was necessary to establish minimum fire-flow demand requirements to be applied to various locations throughout the distribution system, as well as a minimum residual pressure (the pressure near the flowing hydrant) and system pressure. The local agency responsible for establishing fire-flow requirements for the Bay Point System service area is the Contra Costa Fire Protection District. Their fire code regulations were used as a guide to develop the fire-flow criteria established for this master plan, which were presented in the previous section in TABLE 5-3.

6.3 Existing System Hydraulic Analysis

Several hydraulic computer model simulations were conducted for the existing distribution system to identify system and operational deficiencies, and to evaluate system improvements to mitigate these deficiencies. If more than one alternative was possible to mitigate a deficiency, the most cost-effective and constructible improvement was recommended.

6.3.1 Operational Assumptions

GSWC operations staff provided information on how the Bay Point System would normally be operated under ADD, MDD, and PHD periods. Based on this information, the facilities available for the hydraulic analysis of the existing system are presented in TABLE 6-2. (Note: The status of wells, CCWD connections, booster pumps and storage tanks were not based on the model results, but on the amount of supply needed for each demand period. For ADD, there is flexibility to operate various combinations of wells, as not all of the wells need to be operational to achieve the desired pressures; for MDD and PHD scenarios, firm capacity must be used.)

TABLE 6-2 Existing System Operating Facility Status

Facility Name	ADD	MDD	PHD
Wells—Main Zone			
Hill Street #1	Available	Off	Off
Hill Street #2	Available	On	On
Chadwick #3	Available	On	On
CCWD connections			
Hill Street CCWD	Available	On	On
Booster pumps			
Chadwick Booster A	Available	On	On
Chadwick Booster B	Available	Off	On
Evora Booster A	Available	On	On
Evora Booster B	Available	Off	On
Marcia Booster A	Available	On	On
Pacifica Booster A	Available	On	On
Pacifica Booster B	Available	Off	On
Port Chicago Booster A	Available	On	On
Port Chicago Booster B	Available	Off	On
Storage tanks			
Hill Street Reservoir 3	75%	75%	75%
Skyline Reservoir	33%	33%	33%
Evora Reservoir 1	75%	75%	75%
Evora Reservoir 2	75%	75%	75%

6.3.2 Average Day Scenario Analysis

To analyze the average day scenario for the existing system, simulations were performed using the computer model with ADD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 1,243 gpm. Only the facilities listed as 'Available' in TABLE 6-2 were used for ADD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.3 Maximum Day Scenario Analysis

To analyze the maximum day scenario for the existing system, simulations were performed using the computer model with MDD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 2,044 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for MDD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.4 Peak Hour Scenario Analysis

To analyze the peak hour scenario for the existing system, simulations were performed using the computer model with PHD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 3,066 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for PHD. (Note: Storage may be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.5 Fire-flow Scenario Analysis

For this master plan revision, the fire flow scenario was not analyzed.

6.3.6 Analysis Results and Recommended Improvements for the Existing System

Various alternatives were considered to correct the hydraulic deficiencies identified in the hydraulic analysis. The proposed improvements were evaluated for their ability to correct the deficiency and for their cost-effectiveness as compared to other alternatives.

Steady-State Deficiencies

The deficiencies identified in the ADD, MDD, and PHD simulations for the existing system are presented in TABLE 6-3 (Note: This table also includes any existing system improvements for supply and storage from Section 5). These deficiencies were analyzed in detail using the computer model by adding proposed improvements, reviewing the updated results, and repeating this process until acceptable results were obtained.

The distribution system was analyzed to identify areas of the system that experienced pressures below 40 psi or above 125 psi (criteria identified in TABLE 6-1). Various steady-state planning scenarios were used to analyze system pressures under different demand conditions to verify adequate system pressures. Where low pressures were observed during the analysis, one or more approaches were used to mitigate the low-pressure problem. In some cases, low pressures can be corrected with no physical improvement, such as by increasing the pressure setting of an upstream pressure regulating valve. However, sometimes substantial improvements may be required. Improvements may include replacing older pipelines with larger diameter pipelines to reduce friction losses, constructing new pump stations or pressure regulating stations, or modifying the boundaries of an existing pressure zone.

High velocities in water pipelines can also be an indication of an operational deficiency, and can lead to scouring of the pipe lining material or increase the chances of a valve failure. Increased velocities contribute to increased head loss, usually resulting in a less efficient water distribution system. Higher velocities may be acceptable for short-term operation, such as when needed for fire-flow, but otherwise should be lower where practical. The planning scenarios used to analyze the Bay Point System for pressure deficiencies were also used to evaluate the velocities under the same demand periods (ADD, MDD, and PHD). The velocity criteria used to evaluate the distribution system for each demand period were defined in TABLE 6-1.

As stated in footnote ‘a’ of TABLE 6-1, “If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement.” Thus, pipelines with velocities above the criteria identified in TABLE 6-1 but below 10 fps were reviewed for excessive pressure loss resulting in low pressures or excessive energy use. Where the velocities did not appear to contribute to pressure problems or excessive pumping, then no deficiency was identified and no improvement was proposed.

The numbering system used in deficiency tables below is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2040 system. The second number indicates the deficiency number, which starts at 1 and increases by 1 for each deficiency identified. The third number identifies the improvement alternative (zero is reserved for the deficiency identification). Proposed improvements to correct the deficiency are numbered starting at 1. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system. (Note: Deficiencies identified may not start with the number 1.1.0 if there are deficiencies identified in a prior section of this master plan.)

TABLE 6-3 Existing System Deficiencies and Recommend Improvements for ADD, MDD, and PHD

Deficiency/ Alternative Number	Location	Deficiency	Recommended Improvement
1.1.0	**Evora Zone**	**MDD, velocity & headloss**	
1.1.1	8-inch PVC, DI & AC; Powell Dr, Steffa St, Driftwood Dr to Azores Cir, and Azores Circle to Mota Dr		Install secondary 8-inch main from Driftwood Dr to Manuel Ct to eliminate bottleneck

SECTION 7

Water Quality Evaluation

The purpose of this section is to provide documentation of Golden State Water Company's (Golden State Water) water quality assessment for the Bay Point System. Water quality of local groundwater and imported water were evaluated based on current federal and state standards and rules.

7.1 Current Status of Drinking Water Quality

The Bay Point System is supplied by three active wells and two interconnections to the Contra Costa Water District (CCWD). The system has one emergency interconnection with the City of Pittsburg.

The Bay Point System is supplied with local groundwater and chloraminated water purchased from CCWD. To control nitrification, each storage tank within the Bay Point System is monitored weekly during warmer months and monthly during cooler months for nitrite, free ammonia and HPC bacteria. Distribution sites are monitored weekly for total chlorine residual and total coliforms.

The drinking water quality of the Bay Point System must comply with the Safe Drinking Water Act (SDWA), which is composed of primary and secondary drinking water standards. Compliance with primary drinking water standards is regulated by the U.S. Environmental Protection Agency (EPA). Compliance with both primary and secondary standards is required by the State Water Resources Control Board, Division of Drinking Water. Water quality sampling is performed at each well and within the distribution system to ensure compliance with regulatory standards. Compliance monitoring of the purchased water is performed by CCWD.

Water quality sampling is performed at the sources to ensure compliance with all regulatory standards. Sources are sampled per the requirements of Title 22 of the California Code of Regulations. Monitored constituents include general mineral, general physical, inorganic, volatile organic, synthetic organic, and radiological compounds/chemicals. The frequency of monitoring depends on the parameter being tested and the concentration of the constituent in the source. Frequencies range from monthly to once every 9 years.

Distribution system water quality monitoring is performed for several water quality parameters in the Bay Point System, including general physical parameters, presence of coliform bacteria, chlorine residual, disinfection byproducts, and corrosivity of the water by monitoring lead and copper levels at customers' water taps. The distribution system is tested weekly for the presence of coliform bacteria at representative locations throughout the system; disinfection byproduct samples are collected on a quarterly basis. All monitoring parameters and levels currently meet drinking water standards.

7.2 Imported Water Quality

In Bay Point, two purchased water supply connections with Contra Costa Water District (CCWD) are the primary sources of water for the system. CCWD operates two water treatment facilities, the 75 MGD Bollman Water Treatment Plant and the 40 MGD Randall-Bold Water Treatment Plant. Both plants utilize chloramination to disinfect the water prior to distribution. Under special agreement, the Bollman plant provides treated water to the Bay Point System via the Port Chicago Interconnection. The Randall-Bold plant provides treated water to the Bay Point System via the Hill Street Interconnection to CCWD's Multi-Purpose Pipeline (MPP). The MPP is bi-directional allowing the Bay Point System to be fed from the Bollman plant, as needed, for maintenance or other operational issues. In the event of a major emergency, the MPP can also pump untreated water for fire suppression.

CCWD obtains its water supply from the Sacramento-San Joaquin Delta. All of CCWD's intakes are subject to variations in water quality caused by salinity intrusion, as well as discharges into the Delta and its tributary streams from both point and non-point sources. Delta water quality at CCWD's intakes (as measured by chlorides) has declined significantly over the last twenty years. CCWD is implementing a comprehensive water quality strategy to protect and improve source and treated water quality for its customers. This strategy includes seeking improved water quality sources, reducing impacts of Delta agricultural drainage, participating in research on advanced treatment of Delta water and supporting legislative initiatives for improving drinking water quality and source water protection.

7.3 Groundwater Quality

There are three active groundwater wells within the Bay Point System. Hill Street #1 and Hill Street #2 are blended with treated water from the CCWD Hill Street Interconnection to ensure that Federal and State drinking water standards are met within the Bay Point System. Both of the Hill Street wells exceed the recommended secondary MCL (SMCL) for sulfate, total dissolved solids (TDS) and specific conductance (EC) prior to blending. Hill Street #2 also exceeds the secondary MCL for manganese.

Chadwick #3 exceeds the recommended SMCL for TDS and EC. Groundwater from this well is pumped into the Madison Reservoir by the Chadwick Booster Station. The booster station pumps groundwater and water from the distribution system simultaneously. Groundwater typically accounts for less than 25% of the total flow. Blending is provided within the distribution system.

Nitrates are also present in each of the wells in the Bay Point System with average levels between 1.0 to 4.7 mg/L for 2013-2015. As nitrate levels have historically reached 1/2 the primary MCL in Chadwick #3, quarterly monitoring is being performed. The analytical results have shown that the nitrate level is very constant with no upward trend.

7.4 Water Quality Evaluation

The following discussion provides information on the relevant water quality evaluation rules for the Bay Point System, including:

- Chromium (VI)
- Microplastics

7.4.1 Chromium (VI)

In 2011, the Office of Environmental Health Hazard Assessment (OEHHA) set a public health goal for chromium (VI)of 0.02 parts per billion (ppb). With the PHG for this contaminant in place, the DDW is required to set a Maximum Contaminant Level (MCL) for chromium (VI). On July 1, 2014 the State Water Resources Control Board (SWRCB) set the chromium (VI) MCL at 10 parts per billion (ppb). Water purveyors were required to test all sources and comply with the new MCL by 2015. On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the hexavalent chromium maximum contaminant level (MCL) for drinking water. The court also ordered the State Water Board to adopt a new MCL for hexavalent chromium. Chadwick Well #3 detected chromium (VI) at a level of 5.5 ppb during initial monitoring in 2014. Total chromium will be monitored every three years until a new regulation is established.

7.4.2 Microplastics

On September 28, 2018, Senate Bill No. 1422 was filed with the Secretary of State, adding section 116376 to the Health and Safety Code, and requiring the State Water Board to adopt a definition of microplastics in drinking water on or before July 1, 2020, and on or before July 1, 2021, to adopt a standard methodology to be used in the testing of drinking water for microplastics and requirements for four years of testing and reporting of microplastics in drinking water, including public disclosure of those results. Future water quality monitoring may be needed as implementation of this law occurs.

7.4.3 PFAS

Per- and polyfluoroalkyl substances (PFAS) are a varied and sundry group of compounds used in a variety of industrial and commercial applications including fire-fighting foams, clothing, metal plating, and upholstery.

As part of EPA’s third unregulated contaminant monitoring rule (UCMR3) the entry points to the distribution system were monitored for six PFAS including PFOA and PFOS between 2013 and 2015. No PFAS was detected above the method reporting limits. The combined reporting limit for PFOA and PFOS was 60 ng/L.

The following outlines regulatory requirements for PFAS:

- In 2015, the EPA released a health advisory for two PFAS compounds, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), at a combined total of 70 nanograms per liter (ng/L).

- In July 2018, DDW set a notification level for PFOS of 13 ng/L and PFOA of 14 ng/L with a recommendation for source treatment or removal from service at a combined 70 ng/L. In the absence of a federal MCL, several states are in the process of developing MCL for PFAS.

- In March 2019, DDW issued the first phase of mandatory PFAS testing orders for public water systems across California based on proximity to: airports with fire training/response sites and previous PFOA/PFOS detections. The Bay Point water system did not receive a mandatory testing order in the first phase.

- In August 2019, DDW revised the notification levels from 13 ng/L to 6.5 ng/L for PFOS and from 14 ng/L to 5.1 ng/L to PFOA.

The regulatory requirements for PFAS are expected to develop over the next one to three years. Regulations for this emerging contaminant will be closely monitored by Golden State Water.

7.4.4 Assembly Bill 1668

This State Assembly Bill sets an indoor water usage limit of 55 gallon per day per person. The Bill also requires the State Water Resources Control Board, in coordination with the Department of Water Resources to establish long-term standards for the efficient use of water and performance measures for commercial, industrial, and institutional water use on or before June 30, 2022. If the implementation of this legislation results in significant reduction of water usage, it may result in increased water age in the distribution system. This may cause corresponding water quality challenges such as low chlorine residual and nitrification. Future water quality studies may be needed as implementation of this law unfolds over the next two to five years.

7.5 Recommended Improvements

No capital improvements have been identified specifically to address the water quality concerns discussed in the previous sections.

SECTION 8

System Condition Assessment

The purpose of this section is to provide documentation of GSWC's system condition assessment effort for the Bay Point System. This section is organized as follows:

- Previous system condition assessment efforts
- Updated condition assessments

8.1 Previous System Condition Assessment Efforts

More than 10 years ago, GSWC conducted several facility condition assessment efforts, working with multiple engineering consulting companies to develop a complete condition assessment for each of the Company's systems. Facilities in the Bay Point System were addressed in this effort.

Generally, the purpose of these studies was to inspect and evaluate existing facilities to determine if upgrades would produce significant benefit to offset expenditures. These studies included the following information:

- Evaluations of the safety of the facilities
- Outstanding code violations
- A general evaluation of condition and reliability

8.2 Updated Condition Assessments

For this Master Plan, GSWC Operations and Planning personnel reviewed the condition of plant facilities and pipeline data within the Bay Point System in order to identify the facilities requiring upgrade or replacement. For the pipeline conditional assessments, no specific recommendations were made based solely on condition, but age and material were considered along with pipeline leaks/breaks and input from operations staff.

8.2.1 Facility Condition Review

The purpose of this review was to identify plant improvement projects based on the following:

- Operational needs and requests
- Common items that are not installed at all plant sites
- Recommendations from the previous condition assessments that were not installed

GSWC reviewed each of the following elements to identify potential recommended improvements at each facility:

- Electrical
- Mechanical
- Structural
- Other site improvements

TABLE 8-1 summarizes the recommendations that were developed as a result of the system condition assessment review.

TABLE 8-1 2016 Condition Assessment Plant Projects

Alternative Number	Facility	Project Description	Reason	Priority Category
1.2.0	Mota Plant	Raze booster station, maintain emergency connections	Redundant booster location from Hill Street Zone to Evora Zone in the case of Pacifica Booster Station failure	Short-term
1.3.0	System-wide	Recycled water study	Identify potential recycled water customers and cost	Short-term
1.4.0	Hill St Reservoir	Recoat exterior	Prolong reservoir useful life	Short-term
1.5.0	Skyline Reservoir	Recoat exterior	Prolong reservoir useful life	Short-term
1.6.0	Marcia Plant	Upgrade booster station	Existing pump is running 24/7; existing roof is deteriorating and plywood is rotten.	Short-term

8.2.2 Pipeline Condition Review

In addition to facility condition, GSWC monitors distribution system condition through the tracking of pipeline leaks/breaks on an annual basis; FIGURE 8-1 is a map of the leaks in the Bay Point System from 2014 to 2018. This information was used, along with additional risk assessment analysis, to make recommendations regarding potential CIP projects and in the prioritization of those projects. (See GSWC's *Pipeline Management Program Report* and *Risk Based Asset Management Program Report*.)

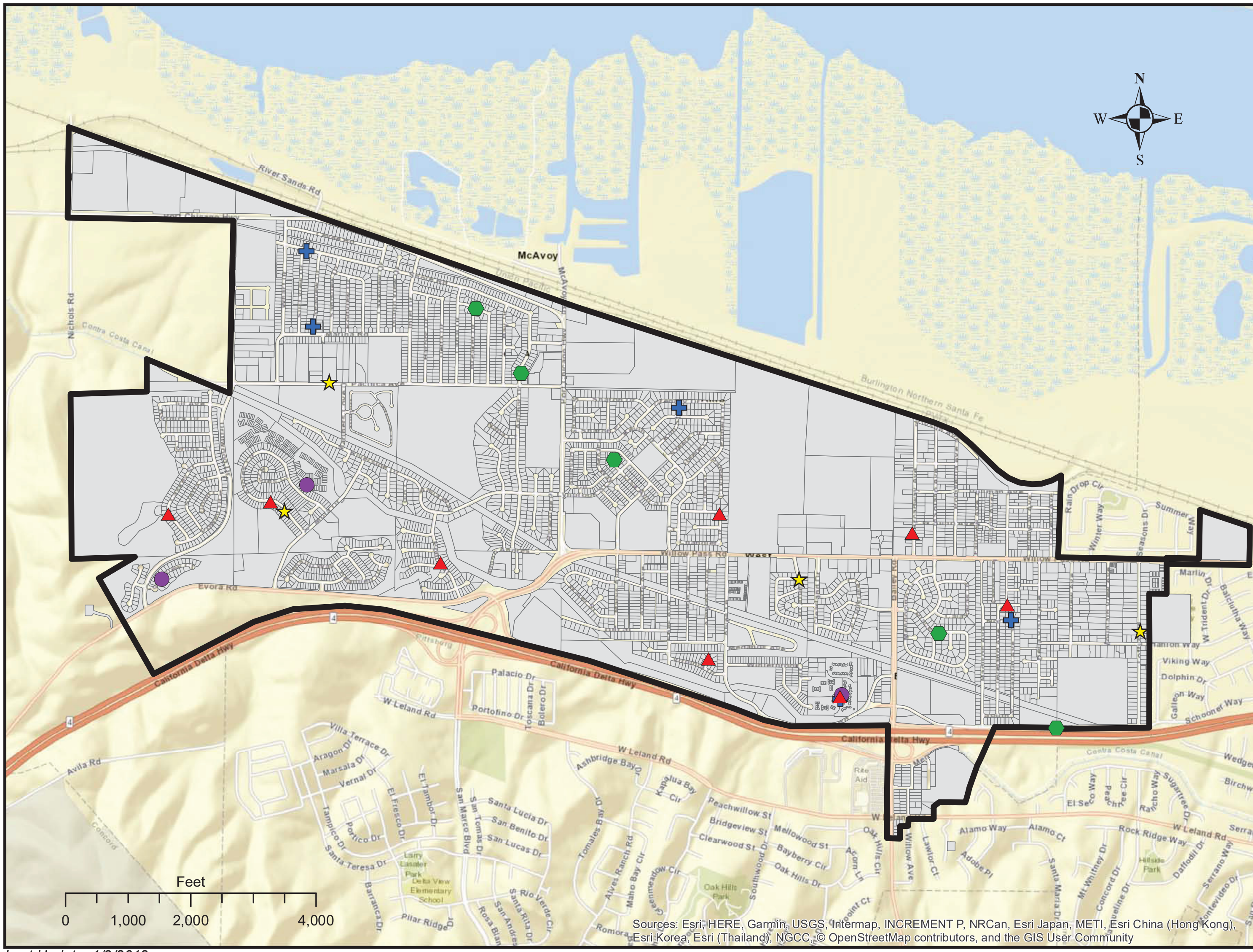
TABLE 8-2 2016 Condition Assessment Pipeline Projects

Alternative Number	Recommended Improvement	Reason	Priority Category
1.7.0	Enes Ave, Clement to s/o EBMUD ROW, Replace 4-inch Steel with approximately 400 LF of 8-inch PVC	Age and material of existing pipeline, replace 4" Steel	Short-term
1.8.0	Manor Dr., Willow Pass to Beverly and Beverly Circle, Approximately 750 LF of 8-inch PVC and 150 LF of 6-inch PVC	Age and material of existing pipeline, replace 2" Steel due to utility conflict, and install steamer hydrant at end of cul-de-sac	Short-term
1.9.0	Contra Costa Canal, Canal Rd. to Ambrose Park	Remove pipeline crossing Contra Costa Canal; above-ground Steel and below-ground AC	Short-term
1.10.0	Lincoln St. Main Replacement, Approximately 200 LF of 6-inch PVC	Age, material and condition of existing pipeline; 1½" Steel has had two leaks in the past 5 years	Short-term
1.11.0	Suisun Ave Main Installation, Approximately 1,000 LF of 8-inch PVC	Eliminate three dead-ends, and old AC pipeline that is in an unmaintainable location (under homes)	Short-term

1.12.0	Ambrose Ave, Hill Street to Willow Pass Rd, Approximately 1,400 LF of 12-inch PVC	Age and size of existing pipeline, replace 4” and 6” AC to improve conveyance capacity from Hill Street	Short-term
2.1.0	Shore Rd., Canal to Lake View, Approximately 1,400 LF of 12-inch PVC	Continue Northwest Conveyance Program from Hill Street Plant to Pacifica Booster Station	Long-term
2.2.0	Alves Ln. (aka Canal Rd.), Virgina to south of Contra Costa Canal, Approximately 300 LF of 6-inch PVC	Replace existing long services over bridge crossing, add FH and set meters on south side of Contra Costa Canal	Long-term

Figures

BAYPOINT SYSTEM LEAK MAP 2014 - 2018



Year & Number of Leaks

- *2014 - 5 Leaks*
- *2015 - 3 Leaks*
- *2016 - 5 Leaks*
- *2017 - 8 Leaks*
- *2018 - 4 Leaks*

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Last Update: 1/9/2019

SECTION 9

Capital Improvement Program

The capital improvement program (CIP) is an essential component of this water master plan. The CIP summarizes recommended facilities, and establishes the priority and timing of necessary improvements. The recommended improvements were analyzed and evaluated in the previous sections of this report.

The recommended improvements were prioritized into two categories—short-term (existing system) or long-term (2040 system)—to identify when these improvements are required. The project selection and prioritization process considered various issues, including existing deficiencies, projected demands, water quality, regulatory compliance, reliability and facility condition.

9.1 Cost Estimation

No cost estimates are included in this master plan, as the final costs of a project, and the project's resulting feasibility, will depend on actual labor and material costs, inflation, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Prior to design and construction of any recommended project in this master plan, a detailed project cost estimate will be created.

9.2 Project Prioritization

The following descriptions define how projects were prioritized into one of the two categories:

- **Short-term improvement projects** were based on deficiencies identified in the existing system. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality. Operational improvements were included as a short-term improvement only when a significant short-term benefit was identified.
- **Long-term improvement projects** are based on deficiencies identified beyond the short-term planning years through the year 2040. The water system was assumed to be built out by the year 2040. The long-term improvements are typically projects necessary to meet future demands and replace or rehabilitate aging infrastructure.

9.3 CIP Projects

TABLE 9-1 lists the recommended improvements for the Bay Point System. Each project is assigned a unique identification number and a priority: short-term or long-term. Short-term pipeline projects are shown on FIGURE 9-1.

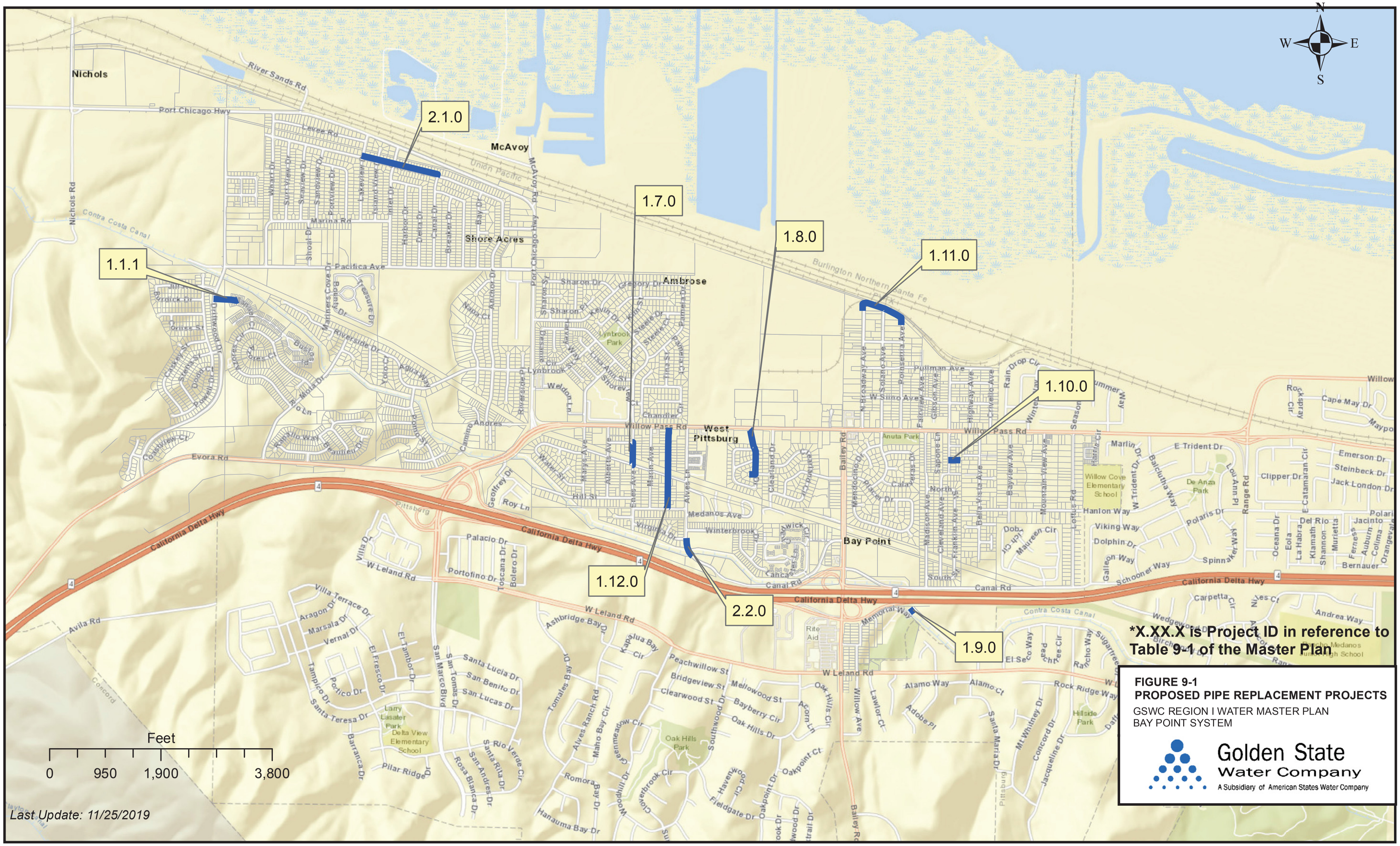
TABLE 9-1 Summary of Recommend CIP Projects

Project ID	Recommended Improvement	Improvement Type	Priority Category
1.1.1	Manuel Ct & Driftwood Dr Main Installation	Hydraulic	Short-term
1.2.0	Raze Mota Plant booster station, maintain emergency connections	Conditional Assessment	Short-term
1.3.0	System-wide Recycled water study	Conditional Assessment	Short-term
1.4.0	Recoat Hill St Reservoir exterior	Conditional Assessment	Short-term
1.5.0	Recoat Skyline Reservoir exterior	Conditional Assessment	Short-term
1.6.0	Upgrade Marcia Plant booster station	Conditional Assessment	Short-term
1.7.0	Enes Ave, Clement to s/o EBMUD ROW Main Replacement	Conditional Assessment	Short-term
1.8.0	Manor Dr., Willow Pass to Beverly and Beverly Circle Main Replacement	Conditional Assessment	Short-term
1.9.0	Contra Costa Canal crossing, Pipeline Removal	Conditional Assessment	Short-term
1.10.0	Lincoln St Main Replacement	Conditional Assessment	Short-term
1.11.0	Suisun Ave Main Installation	Conditional Assessment	Short-term
1.12.0	Ambrose Ave, Hill St to Willow Pass Main Replacement	Conditional Assessment	Short-term
2.1.0	Shore Rd, Canal to Lake View Main Replacement	Conditional Assessment	Long-term
2.2.0	Alves Ln, Virginia to south of Contra Costa Canal Main Installation	Conditional Assessment	Long-term

9.4 Additional Considerations

N/A

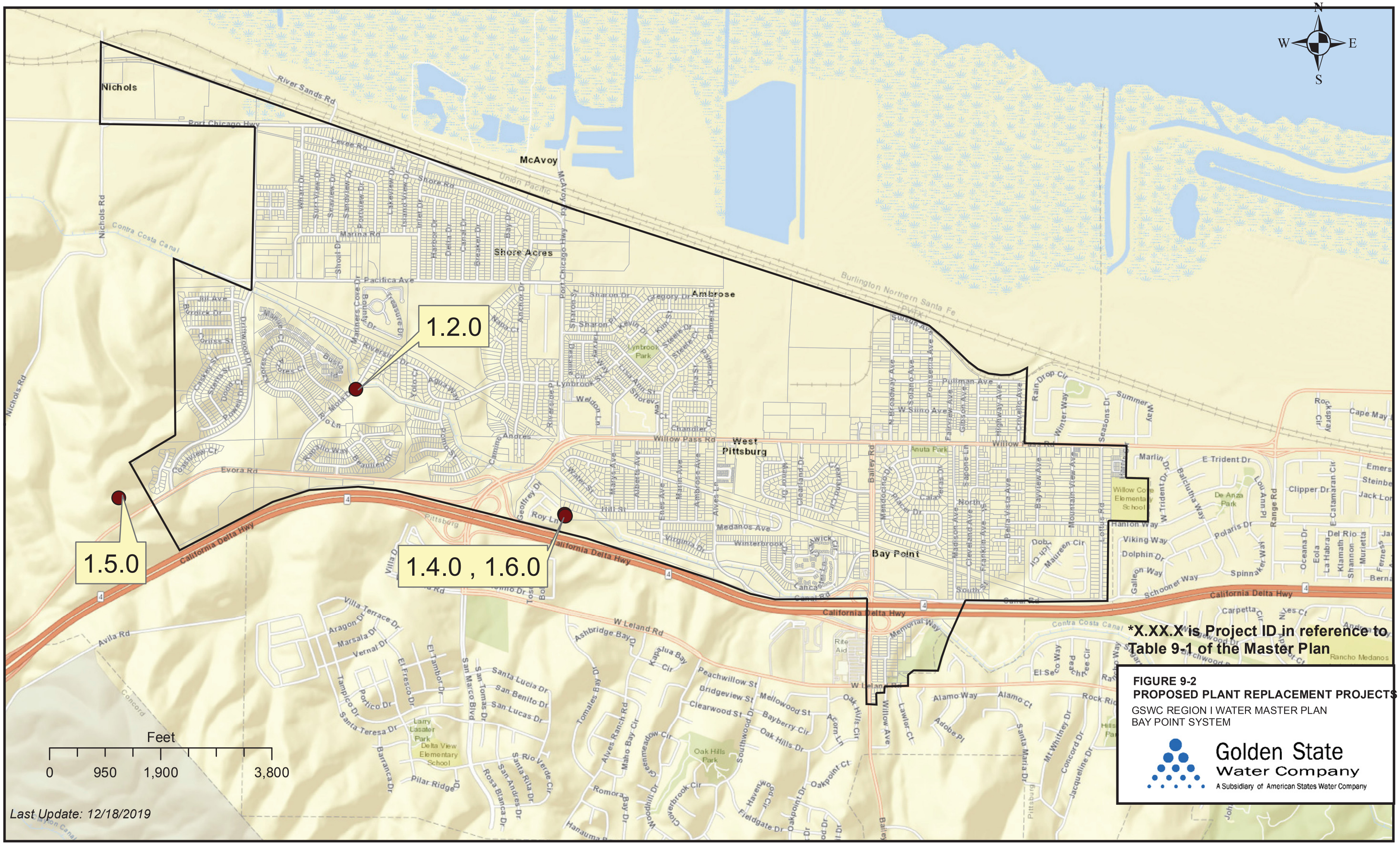
Figures



*X.XX.X is Project ID in reference to Table 9-1 of the Master Plan

FIGURE 9-1
PROPOSED PIPE REPLACEMENT PROJECTS
GSWC REGION I WATER MASTER PLAN
BAY POINT SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company



*X.XX.X is Project ID in reference to Table 9-1 of the Master Plan

FIGURE 9-2
PROPOSED PLANT REPLACEMENT PROJECTS
GSWC REGION I WATER MASTER PLAN
BAY POINT SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

SECTION 10

References

American Water Works Association (AWWA). 2005. *Manual of Water Supply Practices M32: Computer Modeling of Water Distribution Systems.* Denver, Colorado.

California Environmental Protection Agency, State Water Resources Control Board, Division of Drinking Water (DDW). 2016. *California Regulations Related to Drinking Water (Titles 17 and 22, California Code of Regulations).* Sacramento, California. June.

California Public Utilities Commission (CPUC). 2009. *General Order 103-A: Rules Governing Water Service Including Minimum Standards for Design and Construction.* Sacramento, California. September.

GSWC. 2016. Bay Point System Water Master Plan. Rancho Cordova, California. November.

Kennedy/Jenks. 2016. *2015 Urban Water Management Plan – Bay Point.* Rancho Cordova, California. August.